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October 2015

BURSA

METROPOLITAN AREA
MUNICIPALITY

BURSA METROPOLITAN MUNICIPALITY CLIMATE CHANGE ACTION

Corporate and Urban Development for Bursa Metropolitan Municipality
Carbon Footprint Inventory and Bursa Climate Change Action Plan
Plan Project Climate Change Action Plan

VOLUME 2/2

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This report is the second report in the series of studies conducted for the "Institutional and Urban Greenhouse Gas Carbon Footprint Inventory for Bursa Metropolitan Municipality and Bursa Climate Change Action Plan" project. Volume 1 contains the calculations of the institutional and urban carbon footprints of Bursa Metropolitan Municipality, which is the first step in preparing the Bursa Climate Change Action Plan. The Bursa Climate Change Action Plan is included in Volume 2.

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MUNICIPALITY CLIMATE CHANGE ACTION PLAN

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
SMELL	Business As Usual
BBB	Bursa Metropolitan Municipality
BESAÿ	Bursa Bread and Food Industry Trade Inc.
BÿDEP	Bursa Climate Change Action Plan
BTSO	Bursa Chamber of Commerce and Industry
BUAP	Bursa Transportation Master Plan
ICE	Bursa Parks, Gardens and Cultural Services Tourism, Water and Aquatic Products, Health, Construction, Energy Industry and Trade Inc.
BURULAÿ	Bursa Transportation Inc.
BUSKI	Bursa Water and Sewerage Administration
EPDK	Energy Market Regulatory Authority
ICLEI	International Council for Local Environmental Initiatives
ENVERDER	Energy Efficiency Association
ETKB	Ministry of Energy and Natural Resources
IEAP	International Local Government Greenhouse Gas Emissions Analysis Protocol
EPDK	Energy Market Regulatory Authority
IPCC	Intergovernmental Panel on Climate Change (Intergovernmental Panel on Climate Change)
IZODER	Heat, Water, Sound and Fire Insulation Association
KIP (GWP)	Global Warming Potential
OSB	Organized Industrial Zone
SURE	Mass Housing Administration
Turkish Statistical Institute (TÜİK)	Turkish Statistical Institute
UEDAS	Uludaÿ Electricity Distribution Inc.
YEGM	General Directorate of Renewable Energy

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EXECUTIVE SUMMARY

Climate science, at its current level in the early 21st century, can now definitively state that global warming is occurring due to carbon dioxide and equivalent greenhouse gases resulting from human activities, particularly the use of fossil fuels in energy production. It has been shown that continuing current production and consumption methods and habits will lead to serious climate change consequences, resulting in massive environmental destruction, potential mass deaths, and related humanitarian disasters. Since the Industrial Revolution, it has been proven that carbon dioxide emissions from human activities, particularly those related to fossil fuel consumption, have increased far faster than the oceans and forests can absorb. This danger, clearly demonstrated by climate science, has prompted the world to take action.

However, with intergovernmental climate change negotiations progressing so slowly, local governments, which are in closer contact with the public, have become increasingly involved in this issue that directly affects people's quality of life and health. Since the early 2000s, local governments and the alliances and coalitions they form have demonstrated their potential to play significant roles in combating climate change by setting more ambitious goals than their own governments. Today, coalitions formed by local governments have a growing influence in climate negotiations.

Within the scope of the "Urban and Institutional Carbon Footprint Inventory and Bursa Climate Change Action Plan Preparation Project," initiated under the coordination of the Bursa Metropolitan Municipality Environmental Protection and Control Department; firstly, greenhouse gas emission sources were identified, and a greenhouse gas inventory was created at the institutional and city level based on the collected data, and then the identified emissions were analyzed.
The Bursa Climate Change Action Plan has been prepared, which includes actions that can be taken to reduce pollution sources.

The plan identifies the mitigations that the municipality can implement through activities under its control or that it can influence. To provide examples of projects to be implemented to achieve these mitigations, successful examples of climate change action plans from local governments that have conducted similar work on various platforms, and which have been adopted, initiated, and/or successfully completed, have been compiled in a guide prepared within the scope of the same project.

Bursa Greenhouse Gas Emission Inventory

In the creation of the institutional inventory, the most widely used international GHG Protocol [1] was used. In the preparation of the city-scale greenhouse gas emission inventory, the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, developed by the Intergovernmental Panel on Climate Change (IPCC) Working Group on National Greenhouse Gas Inventories, was used as the basis.

City-scale greenhouse gas emissions are assessed within the framework of the International Local Government Greenhouse Gas Emissions Analysis Protocol (IEAP), developed by the International Council for Local Environmental Initiatives (ICLEI), which outlines general principles and a philosophy applicable to all local governments, regardless of their location.

The total carbon footprint of Bursa province is **12,825,146 tons** of CO2e for the year 2014, which was chosen as the reference year . Only **217,957** tons (1.70%) of this originates from the municipality's direct institutional activities. 62.5% of Bursa's total carbon footprint emissions are from fuels used in residential, commercial buildings and industrial facilities, urban vehicle traffic, industrial processes and energy production facilities, solid waste and wastewater, and other emissions from agriculture and livestock, all falling under the Scope 1 category.

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It consists of electricity consumption falling under category 2 of the Scope. As is known, the "Scope" categories in the International Greenhouse Gas Reporting Standards are :1

- **Scope 1 – direct greenhouse gas emissions:** Emissions from all fixed and mobile emission sources owned or directly controlled by the organization. Owned, leased or financially leased assets are included in these sources. The scope limit is determined *by what can be controlled.*
  all sources of emissions.
- **Scope 2 – Indirect energy greenhouse gas emissions:** These are emissions resulting from energy purchased for the organization's activities. This section should include grid electricity used or other types of energy used for heating/cooling purposes.
- **Scope 3 – Other Indirect Greenhouse Gas Emissions:** These are GHG emissions that are within the organization's control and are not indirect emissions, but are caused by the organization's activities. These may result from activities beyond or after the organization's core operations, employee travel, or subcontractor activities.

As shown in the figure below, the city's electricity consumption is the largest source of greenhouse gases, accounting for approximately 38.5% (Scope 2). Scope 1 emissions, which constitute 61.5% of the total inventory, represent greenhouse gas emissions from all buildings, industrial facilities, transportation within the city, and other sources defined as agriculture, livestock, waste, and wastewater.

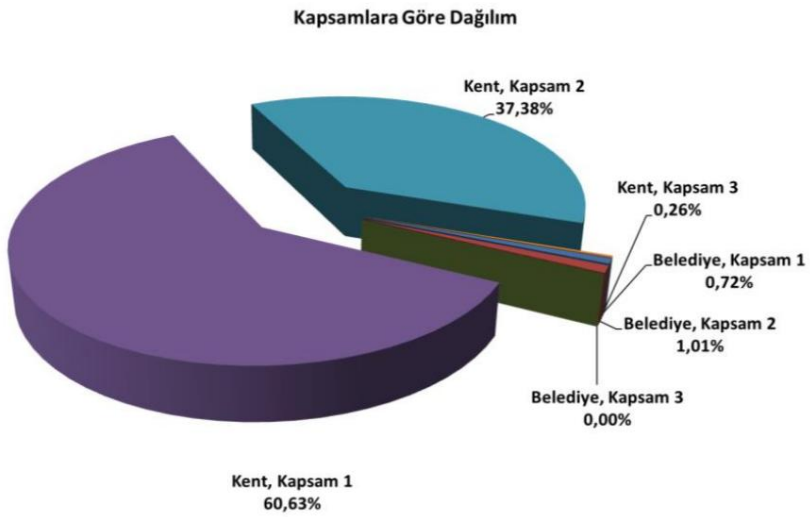

FIGURE 0-1: URBAN GREENHOUSE GAS EMISSIONS IN BURSA BY SCOPE

The “Bursa Climate Change Action Plan” has been prepared based on these values, and targets and actions for emission reduction have been determined compared to 2014. The Bursa city inventory is shown in the table and figure below. A summary of the total is included.

1 *International Local Government GHG Emissions Analysis Protocol (IEAP), ICLEI, 2009*

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TABLE 0-1: TOTAL URBAN GREENHOUSE GAS EMISSION INVENTORY FOR BURSA.

Bursa	MWh	tCO2e	%
Buildings, Equipment/Facility and Energy Consumption in Industries	22.198.338	7.929.941	% 61,8
Energy Consumption in Transportation	9.374.422	2.491.541	% 19,4
Other emissions	0	1.565.373	% 12,2
Energy Production	4.143.326	838.290	% 6,5
Total	**35.715.085**	**12.825.146**	**% 100,0**

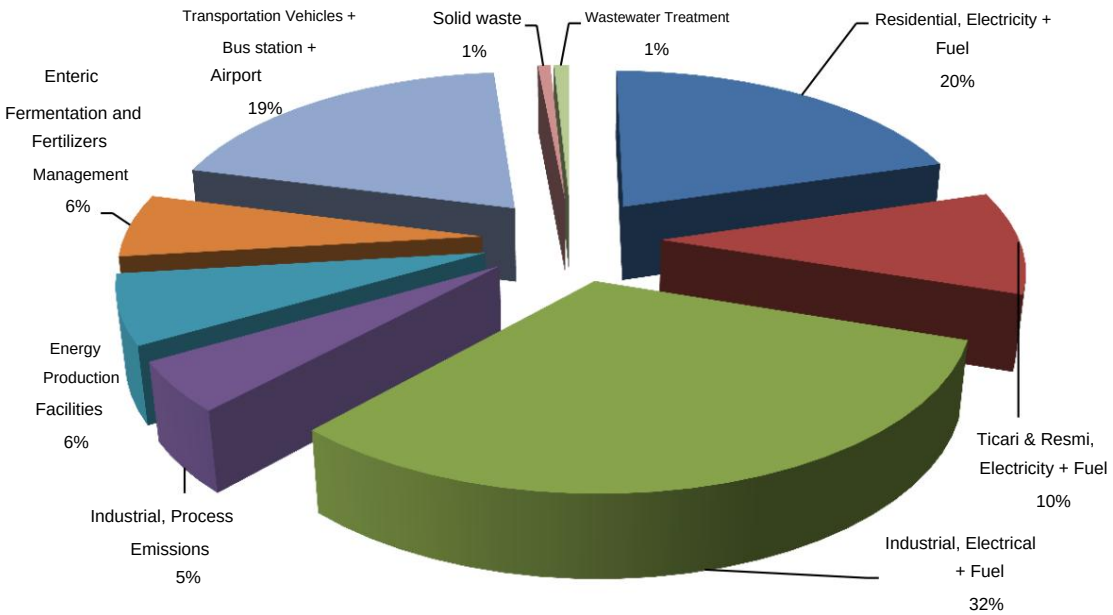

FIGURE 0-2: DISTRIBUTION OF URBAN GREENHOUSE GAS INVENTORY IN BURSA PROVINCE 2014, %

Bursa Climate Change Action Plan (BÿDEP)

Bursa is experiencing rapid growth, with a population increasing above the Turkish average and economic sectors that are at the center of global attention, especially industry.

BÿDEP has been prepared in accordance with Bursa's long-term plans for both transportation and physical development, and is strengthened by the predictions and recommendations of these plans. BÿDEP predicts that Bursa's total greenhouse gas emissions will reach 5.37 by 2030 if no measures are taken. BÿDEP anticipates that with various measures, the emissions will increase compared to the 2014 figures (4.61 tons CO2e/person).
Studies have shown that by achieving approximately a 20% reduction per person, emissions can be lowered to 3.70 tons of CO2e/person.

The study is based on projections regarding energy consumption, taking into account various strategic plans related to the city for urban-scale greenhouse gas emissions. The work carried out by Bursa province in recent years has been very useful in this respect. In particular, Bursa Metropolitan Municipality and

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The "Bursa 1/100000 Scale Environmental Planning Map" prepared by the Bursa Provincial Special Administration and the analysis reports prepared for this plan, as well as the "Bursa Metropolitan Municipality Main Transportation Plan," are the primary resources used.

The report was prepared using annual trends in energy consumption and greenhouse gas emissions, based on projected increases in city strategic plans (population, industry, etc.) since 2015. The table below shows the subheadings detailing the projected savings amounts year by year, achieved through mitigation measures/actions. The reduction rates presented in this report represent the final reduction amounts projected for 2030.

The table below summarizes emission reductions in different categories under their main headings. Various reduction measures or actions within these categories are detailed in the report.
It is being examined.

TABLE 0-2: REDUCTION MEASURES AND SAVINGS AMOUNTS

MITIGATION MEASURES HEADLINES	Energy Saving (MWh)	tCO2e Reduction
Urban Development - Built Environment	3.706.100	1.328.181
Transport	2.969.246	858.445
Renewable Energy	1.405.613	575.493
Solid Waste and Wastewater Management		186.969
Industry and Services	3.733.275	1.473.191
Agriculture, Livestock, Forestry		103.638
Awareness Campaigns	403.815	137.656
Natural energy efficiency	2.616.434	932.915
TOTAL*	**14.834.483**	**5.596.488**

*It is assumed that national policies and technological advancements aimed at energy efficiency will result in a 7% "natural" reduction in emissions.

In particular, mitigation measures that emerged at the end of the workshop and could not be quantified or estimated are explained at the end of each section under the heading "Other Mitigation Measures Discussed at the Workshop".

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Climate science, as it has progressed at the beginning of the 21st century, addresses the issue of carbon dioxide and equivalent greenhouse gases resulting from human activities, and particularly from fossil fuels used in energy production. It can now be stated with certainty that global warming is occurring. It is understood that continuing current production and consumption methods and habits will lead to serious consequences of climate change, resulting in major environmental destruction and potential mass deaths, and related humanitarian disasters.
It has been shown that this will lead to... Since the Industrial Revolution, it has been proven that carbon dioxide emissions from human activities, especially due to fossil fuel consumption, have increased much faster than the oceans and forest areas can absorb.

Climate change is essentially only one dimension of human-caused ecological destruction. Scientists have reached significant findings and conclusions indicating that human presence on Earth has marked a geological era. This era, also called the "Anthropocene" in reference to geological eras, marks a period when human activities began to alter and disrupt the ecological balance of the world. Earth system studies, which indicate that the physical thresholds or red lines of the Earth are beginning to be crossed, have determined that the Earth's ecological system has begun to sound the alarm at 3 out of 9 critical thresholds.

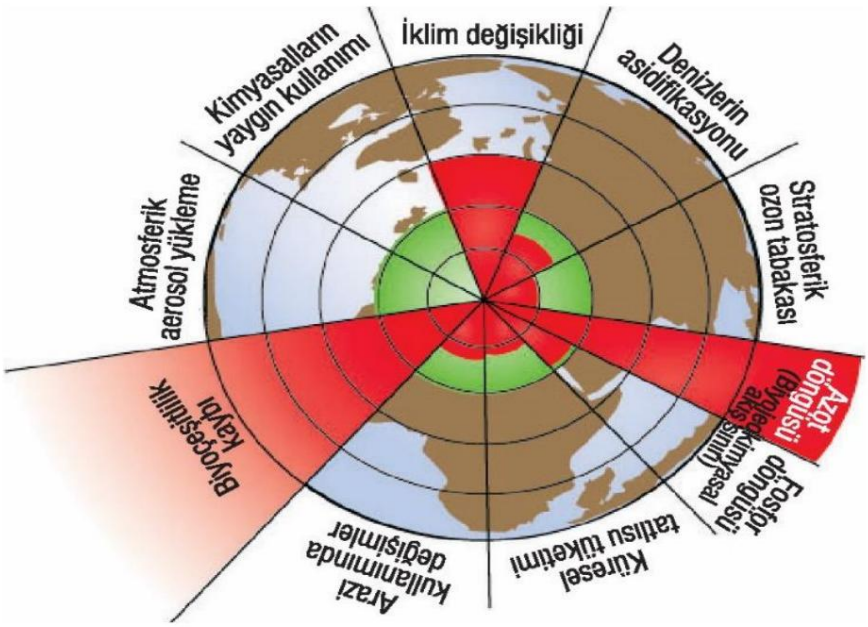

FIGURE 1-1: THE RED LINES OF THE EARTH

The three red threshold levels, indicating the worst levels of ecological imbalance, are as follows:

- Decrease in biodiversity
- Disruption of nitrogen cycles leading to increased ocean acidification
- It is climate change.

Nine key indicators, highly interdependent, summarize findings that suggest fundamental changes are needed in human life worldwide. Climate change, perhaps the most significant of these indicators, points to the fact that all human activities pursued over the last 150-200 years, particularly energy production and consumption, are no longer sustainable in their current forms.

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This danger, clearly demonstrated by climate science, has prompted the world to take action. In 1992, countries around the world came together under **the United Nations Framework Convention on Climate Change** to slow the rate of global warming and address the inevitable problems brought about by climate change. Following this, in 1995, it was realized that the emission reductions under the convention were insufficient, and negotiations were initiated, resulting in the signing of **the Kyoto Protocol** in 1997, which legally obligated developed countries to reduce emissions . Due to various resistances and delays by states and governments, the Kyoto Protocol, which failed to deliver the desired results and whose first commitment period ended in 2012, has been extended until 2020.

With intergovernmental climate change negotiations progressing so slowly, local governments, which are in closer contact with the community, are becoming increasingly involved in this issue that directly affects people's quality of life and health.

In the contemporary world, it can be said that governance and decision-making mechanisms are becoming increasingly localized. Societies are increasingly asserting their will to have a say in decisions concerning their own living spaces. Local governments, and the alliances and coalitions they form, have demonstrated since the early 2000s that they can play significant roles in the fight against climate change by setting more ambitious goals than their respective governments. Today, coalitions formed by local governments have increasing weight in climate negotiations.

1.1 PROJECT OBJECTIVES

This study first examines climate change and the threats it poses, as well as the interaction of cities with this dynamic, from many perspectives. It then describes the intervention attempts by local governments regarding the problems arising from climate change and the processes related to activities that cause climate change.

The Bursa Climate Change Action Plan – BÿDEP, prepared by the Bursa Metropolitan Municipality , will be the most fundamental outcome of this study. The Climate Change Action Plan primarily requires the determination of the Bursa Metropolitan Municipality's emissions at both the institutional and city levels. Accordingly, carbon footprint inventories have been created by documenting and determining these emissions in accordance with international standards. This inventory will also provide a useful basis for recording emissions and monitoring reductions in line with the defined targets.

Following the creation of the inventory, reductions that the Municipality can achieve through activities under its control have been identified. To provide examples for projects that will implement these reductions, inspiration was drawn from successful implementation examples in energy action plans of local governments and cities that have previously conducted similar studies on other platforms, and which have been accepted, initiated, and/or successfully completed. Furthermore, the outputs of a workshop, conducted with broad participation to reflect the views and suggestions of Bursa's local stakeholders in the plan, were also utilized.

The publication includes a summary of the Greenhouse Gas Emission Inventory report, which details the Bursa Metropolitan Municipality's institutional and city-wide emission figures, explaining the calculation methods and specifying the data sources.

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The areas where the development axes and targets determined in the 2014-2023 Draft Regional Plan published by BEBKA overlap with the Climate Change Action Plan are listed below[2] .

- The development axis of "High International Competitiveness";

  The third priority is "Addressing the Deficiencies in Physical Infrastructure in Industry and Improving Logistics Infrastructure". Strengthening"

  The 4th priority is "Strengthening R&D and Innovation Capacities and Increasing Productivity". Increased"

- The development axis of "Balanced Spatial Development and Sustainable Environment"

  Priority 5: "Increasing Accessibility by Ensuring Integration Between Transportation Modes and..." Regulation of Urban Transportation

  Priority 7: "Integrated Solid Waste Management for the Separate Collection, Transportation, Storage, Recycling, and Disposal of Solid Waste within a Specific System" Establishing Their Systems"

  Priority 8: "Developing and Implementing Clean Air Action Plans, and Implementing Climate Change Adaptation Strategies and Plans to Combat Climate Change in the Region"

  Priority 9: "Reducing Waste Generation, Water and Energy Consumption in Industry" Ensuring the Transition to Practices and Clean Production"

  Priority 10: "Identifying and Evaluating the Potential of Local, Renewable, Environmentally Friendly, Economical, Efficient and Sustainable Energy Sources"

  The 11th priority is "Identifying Energy Efficiency Needs, Energy Management". Widespread Adoption and Reduction of Energy Intensity"

  This directly aligns with the 12th priority , "Maximizing the use of local resources to reduce dependence on foreign energy sources and minimizing environmental damage while meeting energy demand."

1.2 PROJECT SCOPE AND METHODOLOGY

The Bursa Metropolitan Municipality's Climate Change Action Plan was prepared using the methods and standards of the international GHG (greenhouse gases) Protocol adopted by the United Nations.

As a first step, a training, information, and team-building meeting was organized, with mandatory participation from senior management and to which all senior executives were invited. **May 21, 2015**
Presentations covering the following topics were given at the all-day meeting held on [date]. The project team received full support from the relevant departments of Bursa Metropolitan Municipality in data collection throughout the project.

The topics covered in the training given at this meeting are as follows:

Local governments in climate negotiations,
Introduction to the Project and Expectations,
Climate Change from A to Z: The Basics,
The Relationship Between Cities and Climate Change,
What Can Be Done at the City Level - Examples from Cities Around the World,
Introduction to Inventory Calculation,
Why should cities prepare greenhouse gas inventories?

2 *BEBKA 2014-2023 Regional Plan, December 2014*

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What are the methods for calculating greenhouse gases in those cities?

The benefits of that inventory,

Examples from around the world,

The steps for inventory calculation,

Defining the Scope and Boundaries in Inventory Preparation,

Data Collection, Planning and Processing,

Setting Mitigation Targets,

Reporting of Inventories,

Data for corporate and city-scale emission inventories was obtained from non-municipal institutions (e.g., electricity and natural gas distribution companies, organized industrial zones, etc.), and the local government provided support at all levels in this regard.

Following the completion and verification of the data, baseline emission inventories at the institutional and city levels were created to serve as a basis for the entire study and subsequent roadmap.

The most widely used international GHG Protocol [1] was used in creating the corporate inventory.
The preparation of city-scale greenhouse gas emission inventories is based on **the 2006 IPCC Guidelines for National** Greenhouse Gas Inventories, developed by the Intergovernmental Panel on Climate Change (IPCC) Working Group on National Greenhouse Gas Inventories.
It is based on...

While the emission sources that should be included in greenhouse gas emissions reports and the methodologies used to quantify these sources vary among institutions, organizations, and sectors, they do not differ among local governments. The International Local Government Greenhouse Gas Emissions Analysis Protocol (IEAP), created by the International Council for Local Environmental Initiatives (ICLEI), is based on general principles and a philosophy applicable to every local government, regardless of its location. ICLEI was founded in 1990 and has been operating under the name Local Governments for Sustainability since 2003. The IEAP;

- IPCC 2006 methodologies,
- WRI/WBCSD GHG Protocol,
- ISO 14064 GHG Standard series and
- Global Reporting Initiative (GRI) Public Sector Institutions Team

It has been compiled based on...

When preparing emissions reports under the IPCC, it is necessary to choose between approaches called TIER 1-2-3 (Level 3 1-2-3) depending on the level of detail, breakdown, accuracy, and reliability of the available data types . For the assessment conducted for Bursa Metropolitan Municipality, the TIER 1 and TIER 2 approaches were selected.

3 IPCC Tier 1-2-3: Methodological approaches whose complexity and accuracy increase with the number of items.

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TABLE 1-1: DATA QUERYED FOR EMISSION DETAILS AT THE CITY LEVEL IN BURSA.

Subject	Data Type	Assigned Unit
Building fuel consumption	Natural gas, LNG, fuel oil, and solid fuels in residential, commercial, and industrial settings.	EPDK, Bursagaz
Building electricity consumption	Electricity consumption by residential, commercial, and industrial categories.	UEDAÿ, TUIK
Street, park and garden lighting, traffic.	Monthly breakdown of electricity consumption data and subscriber numbers.	UEDAÿ, TUIK
Building Stock	Ownership, operation, number of people, qualifications, intended use, enclosed area, energy performance data.	BBB
Transport	Bursa transportation-related greenhouse gas emissions (vehicle type, frequency of use, purpose of use, consumption data, etc.)	Turkish Statistical Institute (TUIK), Energy Market Regulatory Authority (EPDK), Bank of Turkey (BBB)
Waste sites and wastewater treatment plants	Technology used in waste disposal sites, condition of the waste disposal site, technology used in wastewater treatment plants.	BBB, BUSKÿ, Provincial Directorate of Environment and Urbanization
Agriculture, Forestry and Livestock farming	Agricultural areas, amounts of fertilizers and pesticides used, animal numbers, and forest areas in Bursa province.	Provincial Directorate of Agriculture, Forestry Regional Directorate, Turkish Statistical Institute (TUIK)

In the second step, a process was initiated to determine measures to reduce urban greenhouse gas emissions. At the beginning of this process, a workshop was organized involving all urban stakeholders. At the “Bursa Plans Its Sustainable Future” Workshop, held on **September 10, 2015 ,** the draft results of the carbon footprint inventory were shared, and issues closely related to the city's future were discussed with relevant public institutions, civil society organizations, local government units, and all relevant individuals and groups. Following informative presentations on the project, participants from different stakeholder groups were divided into six main themes for group work.

1. Physical Development of the City - Built Environment, 2. Industry and Services, 3. Renewable Energy, 4. Transportation, 5. Waste and Wastewater Management, 6. Agriculture, Animal Husbandry and Forestry

Group work was conducted in two stages.

In the first phase, each subgroup sought answers to the questions briefly summarized above, focusing on plans and scenarios for the city's development towards 2030.

In the second stage, each group was asked to develop project proposals to be considered in action plans and to prioritize these proposals. The top 5 strategic proposals from each theme group were selected as priorities.

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The groups were asked to elaborate on their proposals. The details regarding the proposals included: the responsible institution/organization, funding needs, risks, implementation steps and timeline, energy intensity, or potential impacts on greenhouse gas emissions. Following this approximately four-hour session, each group presented their proposals, and these presentations were opened for discussion.

The findings of this workshop will be discussed in the relevant sections of the report.

PHOTO 1: IMAGE FROM THE TRAINING ON MAY 21, 2015.

PHOTO 2: IMAGES FROM THE WORKSHOP ON SEPTEMBER 10, 2015.

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2. JUSTIFICATION FOR THE PROJECT

2.1 CLIMATE CHANGE AND THE HUMAN FACTOR

Natural greenhouse gases released into the atmosphere by humans, along with other living organisms, are removed from the atmosphere by many natural activities and processes, primarily those of plant origin. From this perspective, biological human activities do not have a negative impact on the greenhouse effect. However, societies, through their other activities, increase the accumulation of greenhouse gases in the atmosphere, creating a net and negative impact on the natural greenhouse effect and triggering a series of chain reactions.

The most fundamental impact, the increase in global average temperature, is leading to various changes in global climate systems that affect the availability and distribution of natural resources, primarily irregularities in precipitation patterns. These changes are reflected in socio-economic structures, determining production and distribution patterns and directing migrations. In this context, societies must consider both reducing greenhouse gas emissions and adapting to potential future impacts if no precautions are taken. (Intergovernmental Panel on Climate Change (IPCC))

According to the scientific findings included in the 5th Assessment Report completed in 2013, atmospheric accumulations of carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) gases...
(Concentrations) have reached levels higher than at any time in at least the last 800,000 years. CO2 accumulations have increased by 40% compared to the pre-industrial era, primarily due to emissions from fossil fuel combustion and secondarily from net land-use change.
Oceans have acidified by absorbing approximately 30% of human-caused carbon released into the atmosphere. According to the IPCC Working Group 1, Assessment 5 report, human impact is the leading cause of atmospheric and ocean warming. Human impact has been detected in changes in the global water cycle, reductions in snow and ice, global average sea level rise, and changes in some extreme weather events. Evidence of human impact has increased since the IPCC 4th Assessment Report (AR4). It is very likely (95-100%) that human impact has been the dominant cause of warming observed since the mid-20th century (1951-2010).
The increase in greenhouse gas emissions is projected to raise global average temperatures by between 2.7 and 5.8°C by the end of 2100 compared to pre-Industrial levels, according to both optimistic and pessimistic scenarios under current practices. These projected temperature increases may be greater than those observed in the 20th century and, based on historical climate data, are considered highly likely to be the largest temperature increase seen in the last 10,000 years.

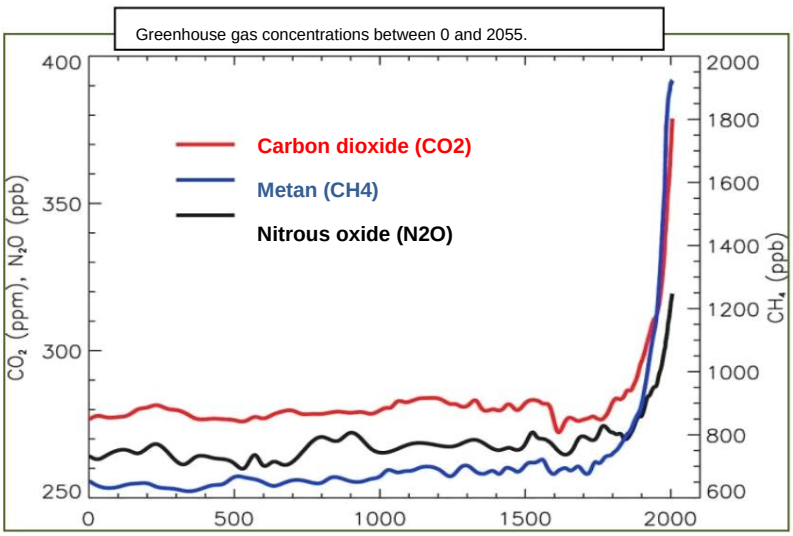

FIGURE 2-1: HISTORICAL DEVELOPMENT OF GREENHOUSE GAS CONCENTRATIONS, IPCC 4TH ASSESSMENT REPORT.

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The world is becoming increasingly urbanized. 2008 was a milestone in this respect. In 2008, the world's urban population surpassed its rural population. This enormous transformation and urbanization is taking place primarily outside of developed industrialized countries in the 21st century. Cities have begun to become significant players in the global economy, both in terms of population and economic power.

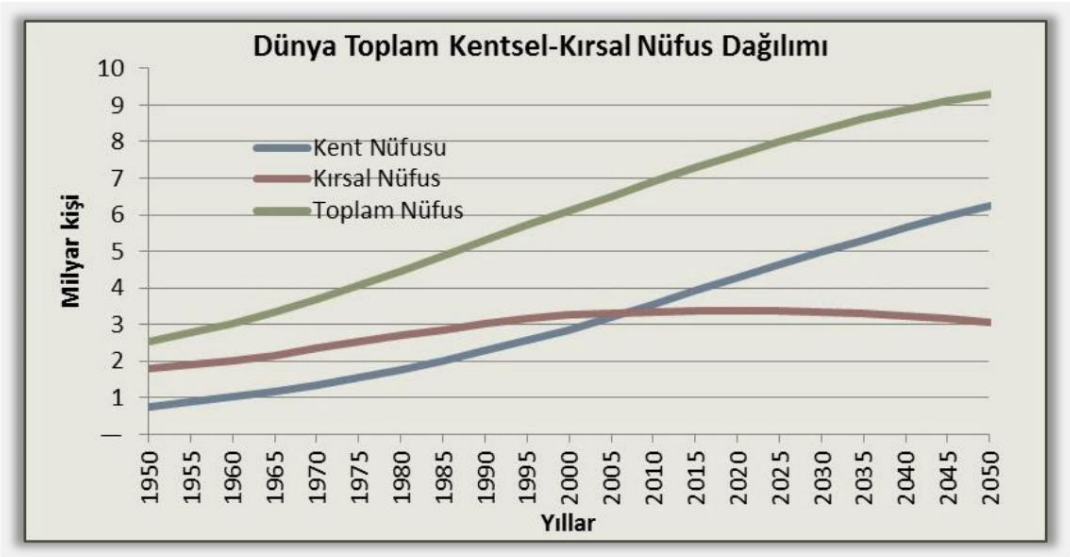

FIGURE 2-2: HISTORICAL DEVELOPMENT OF RURAL AND URBAN POPULATIONS IN THE WORLD, UN URBANIZATION REPORT

Türkiye's First National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), dated January 2007, states that climate change is already manifesting itself in the form of increasing summer temperatures, decreasing winter rainfall in western provinces, reduced surface water levels, increased frequency of droughts, soil degradation, coastal erosion, and flooding. These consequences have serious negative impacts on the water needs for agriculture and rural development, and the severity of these impacts is expected to increase. These consequences will affect both biodiversity and local economies.

2.1.1 URBANIZATION OF CLIMATE CHANGE

Humanity's urban capacity, accumulated over 4,000 years, is expected to multiply at the same rate in the next 40 years. In both developed and developing countries, cities are meeting their increasing energy consumption not through manufacturing activities, but through lifestyle-related energy services such as lighting and transportation. Thermally insulated, air-conditioned, electronic-equipped living spaces, are places where energy can be used more efficiently and costs can be reduced compared to dispersed rural areas. On the other hand, current forms of spatial expansion, consumer habits, and architectural trends are causing growing urban populations to continue to be sources of increasing greenhouse gas emissions.

The central role of cities in climate change has been included in international discussions since the fifth assessment report of the Intergovernmental Panel on Climate Change. The long service life of urban infrastructures highlights the urgency of transforming existing infrastructures into low-carbon infrastructures. Controlling direct and indirect urban emissions is crucial.

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The potential of controlling emissions to reduce total greenhouse gas concentrations is clearly shown in McKinsey's Towards a Low-Carbon Economy4 report.

The methods and principles chosen for the design, planning, and construction of urban areas will determine whether the wave of urbanization represents a significant opportunity for solving climate change or a colossal problem. The success of combating global warming will largely depend on creating low-carbon sustainable lifestyles in cities.

2.1.2 CLIMATE CHANGE AND URBAN THREATS

Many of the world's developing cities are located on coastlines and are directly threatened by rising sea levels, storms, and other volatile climate events. Numerous recent climate events have demonstrated the dangers facing urban infrastructure, buildings, and the urban population itself. The summer *heat wave* effect is linked to urban expansion and the increase in the average height of buildings. The resulting *urban* heat island effect manifests itself through the negative impacts experienced by large segments of the population in urban areas. In both developing and developed countries, cities housing large portions of the poor are directly threatened because these segments live in substandard structures (slum-like buildings) and in unsuitable locations (riverbeds and floodplains). The economic resources of these groups are insufficient to protect them from unexpected climate events or sudden, adverse weather changes.

2.1.3 CLIMATE CHANGE AND URBAN ACTION

Looking at the last 20 years of the Kyoto Protocol, the enforcement agreement of the United Nations Framework Convention on Climate Change, it is easily seen that the weight has been given primarily to governments, large international corporations, and essentially market mechanisms.

It is widely accepted that climate change negotiations have stalled due to the inability to overcome national economic conflicts of interest in numerous successive international meetings. This frustrating situation has led local administrations and city governments to organize themselves in a way that allows them to exert their influence on the negotiations. The umbrella organizations and institutions formed by local governments have implemented far more progressive goals and strategies for combating climate change than their counterparts in central government.

ICLEI's global initiatives include ***the World Mayors and Local Governments Climate Protection Agreement ,*** the US Conference ***of Mayors Climate Protection Agreement ,*** and ***the Local Government Climate Roadmap .***

The Covenant of Mayors ***in*** EU countries is a prime example in this area.

These are examples.

The EU *Covenant of Mayors* is essentially based on **the EU Climate and Energy Package ,** unilaterally adopted by the EU in 2008. Also known as the 20-20-20 plan, this program aims to reduce greenhouse gas emissions by 20% across the EU by 2020, achieve 20% energy savings through increased efficiency, increase the share of renewables in the energy mix to 20%, and reduce vehicle consumption by a certain percentage.

4 Pathways to a Low-Carbon Economy, McKinsey & Company, 2009

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It aims for a 10% share of biofuels. The EU's **Energy Efficiency Action Plan** also proposes a *Covenant of Municipalities* led by local governments at the local and regional level . This political commitment shown by the mayors, exceeding the scope of urban sustainability outlined by the EU's ***Leipzig Charter, the Aalborg +10 Commitments ,*** and ***Agenda 21,*** has given hope to the world public opinion, which has been disappointed by intergovernmental negotiations.

ICLEI has invited all active parties in global climate negotiations to take steps to implement ***the Cancún Outcomes ,*** which were agreed upon at the 16th Conference of the Parties in Cancún, Mexico, in December 2010. The Cancún Outcomes stipulate that local governments should have equal influence with central governments in climate negotiations and participate as equal stakeholders.

2.1.4 CLIMATE CHANGE AND URBAN OPPORTUNITIES

- **Because cities are at the heart of energy consumption and greenhouse gas emissions, they are also at the heart of the fight against climate change.**

The structural densities and spatial organization of cities and urban areas are the primary causes of energy consumption trends and greenhouse gas emission intensities. Living, working, and transportation habits are directly related to the organization of urban space. For example, in Japanese cities, which have a population density five times higher than Canadian cities, unit energy consumption is only about 40% of that in Canada. The selection of technologies to be used in supplying the energy needed by the city also plays an extremely critical role.

- **Due to densities and scale, the economic feasibility of urban low-carbon policies is currently under review. The degree is high.**

Options for urban energy trends in combating climate change are all cost-effective measures, primarily focusing on energy efficiency. Activities such as air pollution control measures, increased green spaces, and less car-more public transport programs, which are necessary to increase the attractiveness of cities, directly contribute positively to the health of urban residents as well as to greenhouse gas reduction policies.

The cost of delaying climate change mitigation and low-carbon policies due to high costs should be much higher in the medium term.

In addition, it is seen that urban green economic renewal can create innovation-based economic growth axes in countless areas that will closely affect a very large part of the economy, from energy supply to transportation methods and approaches, from new energy-efficient building stock to urban infrastructure construction, all through climate measures.

- **Cities implement innovative climate policies that help or even lead national policies. By doing so, they can essentially function as a laboratory.**

The failure of international climate negotiations to achieve the expected level of solutions and the resulting disappointment have led to the gradual emergence of urban-scale solutions and urban organizations. Today, city administrations have equal weight as participants in international climate negotiations as national governments. In many cases, city administrations set and achieve climate goals far ahead of national governments. Many international organizations operate in this field.

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Collaboration and action have been put into practice. International organizational structures have been established to enable local administrations to take a more active role and to shape and implement existing climate policies. These local government organizations are demanding a series of policy stances and changes from the governments:

- *Revising national climate targets to include local government targets,*
- *More than the experience of local governments in preparing emission reports benefiting from,*
- *Ambitious local governments behind the climate change financing program known as the "Green Climate Fund" shifting to their goals,*
- *Clean* ***Development Mechanism*** *as defined in international agreements Mechanism),* ***Nationally*** *Appropriate Mitigation Action and* ***Low-*** Making low carbon ***development strategies*** *available to local governments for achieving ambitious climate goals,*
- As was the case with *the UN* ***Convention on Biological Diversity ,*** *local governments should be more effectively involved in the UNFCCC negotiations and the process.*
- *Updating the term 'government stakeholders' and their roles in* ***the Rio+20*** (UN Conference on Sustainable Development) process document to include local government stakeholders.

2.2 ADDED VALUE CREATED BY CLIMATE CHANGE ACTION PLANS

Local governments, as the closest administrative units to the people, are ideally positioned to understand the concerns and needs of human communities. In addition, they can comprehensively address administrative challenges and facilitate reconciliation between public and private interests. Local governments can ensure the integration of sustainable energy into overall local development goals, whether through the expansion of renewable energy, increased energy efficiency, or the creation of behavioral changes. Therefore, local governments need to be leading players in the implementation of sustainable energy policies, and their efforts should be recognized and supported.

The Covenant of Mayors is an ambitious European Commission initiative that empowers cities to lead the way in slowing and mitigating climate change through the implementation of smart, local, sustainable energy policies that create lasting employment, improve quality of life, and address critical social issues in Europe. The formal commitments of signatory parties are presented in the form of concrete measures and projects. Signatory cities agree to report on and be monitored regarding the implementation of their action plans, and accept termination of their relationship with the Covenant if they fail to comply with their obligations.

Under the Covenant of Mayors, mayors generally commit to voluntary and unilateral reductions in CO_2 emissions, often exceeding EU targets. Cities that sign the covenant aim to reduce CO_2 emissions.
It aims to reduce emissions by at least 20% by 2020 through energy efficiency and renewable energy action plans. To achieve this goal, local governments are making the following commitments:
It is located at:

- Prepare a Baseline Emissions Inventory within one year of accession

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- A Climate Change resolution approved by the city council within one year of accession
  Presenting an Action Plan
- Implementation reports every two years indicating the degree of implementation and interim results of the IDEP (Integrated Development Program).
  to publish,
- Including organizing Local Energy Days at regular intervals, promoting their activities and engaging citizens/
  to ensure stakeholder participation,
- Organizing important events and thematic workshops, especially by encouraging other local authorities to participate.
  By participating, we can spread the message of the Covenant of Mayors.

Nine municipalities in Türkiye (Antalya, Karÿÿyaka, Bornova, Seferihisar, Kadÿköy, Eskiÿehir Tepebaÿÿ, Çankaya, Nilüfer, Maltepe and ÿzmir Municipalities) have become parties to this agreement. The municipalities from Türkiye that have submitted Sustainable Energy Action Plans, as committed to by the signatories of the Covenant of Mayors, are Karÿÿyaka, Bornova, Kadÿköy, Seferihisar, Eskiÿehir Tepebaÿÿ, and Antalya Metropolitan Municipalities.

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3. BURSA CARBON FOOTPRINT INVENTORY

The analysis of city-scale emissions should include all greenhouse gas emission analyses generated within the geographical and administrative boundaries of the local government. The city-scale inventory should also explain the consequences of activities and decisions within the region, regardless of where the emissions occurred geographically.

Each of the numerous activity areas falling within the jurisdiction of a local government requires the development of its own specific greenhouse gas management programs. Local government greenhouse gas emission inventories consist of two parts:

1. Emissions related to the local government's own activities,
2. Emissions related to community activities within the administrative area for which responsibility is held.

Emissions from local government activities are similar to those of a somewhat more complex private sector organization. Therefore, the calculations are not significantly different from the emission inventory requirements outlined in the Corporate Accounting and Reporting Standard under the Greenhouse Gas Protocol, developed by the World Resources Institute and the World Business Council for Sustainable Development.

Calculating **emissions at the city level** requires a different approach and methodology than that used when calculating national greenhouse gas emission inventories.
One of the main reasons for this is the difficulty in determining the local level of activities that lead to greenhouse gas emissions.

Establishment boundaries

Bursa Metropolitan Municipality has been responsible for the entire province since the 2014 local elections.
The energy consumption of the municipality's four largest subsidiaries – BURULAÿ, BUSKÿ, BURFAÿ, and BESAÿ – has also been included in the corporate inventory.

Activity limits

In the GHG Protocol, release categories are classified as follows:

- **Scope 1 – direct greenhouse gas emissions:** Emissions from all fixed and mobile emission sources owned or directly controlled by the organization. Owned, leased or financially leased assets are included in these sources. The scope limit is determined *by what can be controlled.*
  These are all sources of emissions. This scope should include refrigerant gases from air conditioning systems used for the activities.
- **Scope 2 – Indirect energy greenhouse gas emissions:** These are emissions resulting from energy purchased for the organization's activities. This section should include grid electricity used or other types of energy used for heating/cooling purposes.
- **Scope 3 – Other Indirect Greenhouse Gas Emissions:** These are GHG emissions that are within the organization's control and are not indirect emissions, but are caused by the organization's activities. These may result from activities beyond or after the organization's core operations, employee travel, or subcontractor activities. The decision parameter in this scope should be the level and quality of the available data.

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The total carbon footprint of Bursa province for 2014 was 12,825,146 tons of CO2e. Of this, 216,970 tons originated directly from the municipality's institutional activities (1.70%). As shown in the figure below, the city's electricity consumption is the largest source of greenhouse gases, accounting for approximately 37.5% (Scope 2). Scope 1 emissions, which constitute 62.5% of the total inventory, represent greenhouse gas emissions from all buildings, industrial facilities, transportation within the city, and agriculture, livestock, waste, and wastewater, as defined as "other".

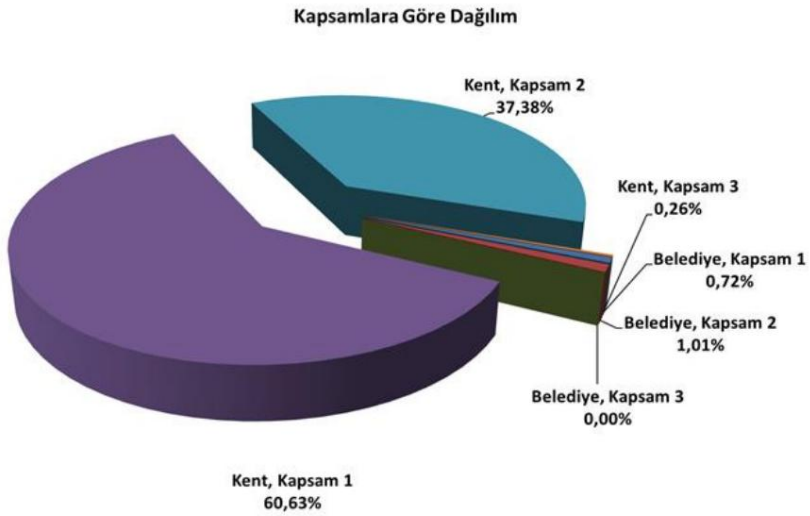

FIGURE 3-1: DISTRIBUTION OF GREENHOUSE GAS EMISSIONS IN BURSA BY CATEGORY, %

Source: Corporate and Urban Carbon Footprint Inventory Report for Bursa Metropolitan Municipality

TABLE 3-1: BURSA METROPOLITAN MUNICIPALITY INSTITUTIONAL GREENHOUSE GAS INVENTORY, 2014

Council					
Category		CO2	CH4	N2O	Total
		ton CO2e			
Buildings and Facilities					**52.897**
Scope 1	Stationary Combustion Emissions	7.884	90	16	7.990
Scope 2	Electricity Consumption	44.768	16	124	44.907
Street Lighting and Traffic Lights					**61.375**
Scope 2	Electricity Consumption	61.184	21	169	61.375
Scope 3	Electricity Consumption				-
Vehicle Fleet					**11.697**
Scope 1	Moving Combustion Emissions	11.500	15	182	11.697
Scope 2	Electricity Consumption of Electric Vehicles	-	-	-	-
Public Transport					**91.605**
Scope 1	Public Transportation Vehicles: Municipal Buses	68.017	89	1.067	69.174
Scope 1	Public transportation vehicles, air transportation.	788	0	7	795
Scope 2	Electricity Consumption of Public Transportation Rail Systems	20.737	7	57	20.801
Scope 3	Employee transportation	828	1	6	835
Smuggled Emissions					372
Scope 1	Air conditioning gases	372			372
Other Scope 3 Emissions					**11**
Scope 3	Flights	11	0	0	11
Total		**216.090**	**240**	**1628**	**217.957**

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To determine mitigation strategies, greenhouse gas emissions are broken down into sub-sectors according to international notations, as shown in Table 3-2, with breakdowns under different headings.

TABLE 3-2: GREENHOUSE GAS INVENTORY AT THE URBAN LEVEL OF BURSA PROVINCE, 2014.

Kent					
Category		CO2	CH4	N2O	Total
		ton CO2e			
Housing					**2.612.599**
Scope 1	Stationary Combustion Emissions	1.638.137	85.347	12.270	1.735.754
Scope 2	Electricity Consumption	874.122	304	2.418	876.845
Ticari&Resmi					**1.245.184**
Scope 1	Municipality's Static Combustion Emissions	7.884	90	16	7.990
Scope 1	Stationary Combustion Emissions	362.247	136	200	362.582
Scope 2	Municipality Electricity Consumption	105.952	37	293	106.282
Scope 2	Electricity Consumption	765.574	266	2.118	767.958
Scope 1	Municipal air conditioning gases	372	-	-	372
Industrial					**4.072.530**
Scope 1	Stationary Combustion Emissions	995.261	41.152	7.606	1.044.019
Scope 2	Electricity Consumption	3.019.109	1.050	8.352	3.028.512
Free Consumer					-
Scope 2	Electricity Consumption	-	-	-	-
Energy Production Facilities					**838.291**
Scope 1	Stationary Combustion Emissions	837.515	314	463	838.291
Transport					**2.491.541**
Scope 1	Municipality's Moving Combustion Emissions, Moving	80.306	105	1.255	81.666
Scope 1	Combustion Emissions, Public	2.317.712	2.817	34.699	2.355.228
Scope 2	Transportation Rail System, Electricity Consumption,	20.737	7	57	20.801
Scope 3	Moving Combustion Emissions - Bus Station,	27.149	36	426	27.610
Scope 3	Transportation of Municipal Employees	828	1	6	835
Scope 3	Airport	5.354	1	47	5.401
Industrial Process Emissions					**604.662**
Scope 1	Cement process emissions	604.662	0	0	604.662
Solid waste					**85.951**
Scope 1	Methane Emissions	-	85.951	-	85.951
Wastewater					**105.381**
Scope 1	CH4 and N2O Emissions	-	77.256	28.125	105.381
Agriculture and Land Use					**769.007**
Scope 1	Enteric Fermentation	-	370.332	-	370.332
Scope 1	Fertilizer Management	-	79.677	-	79.677
Scope 1	Use of Chemical Fertilizers	318.999	-	-	318.999
Total		**10.432.856**	**744.364**	**94.714**	**12.825.146**

Source: Corporate and Urban Carbon Footprint Inventory Report for Bursa Metropolitan Municipality

The calculations indicate that Bursa's urban greenhouse gas emissions are approximately 12.8 million tons of CO2e . As expected for urban emissions, this total largely stems from energy consumption in the residential, transportation, and industrial/ commercial categories. In contrast, the scale of existing industrial activities in Bursa has driven emissions in this category to the top, with emissions primarily from Scope 1 and 2, originating from energy use in industrial activities, reaching just over 4 million tons. Following this category, as expected, greenhouse gas emissions from residential and transportation amount to approximately 2.6 million tons and 2.4 million tons of carbon dioxide equivalent, respectively. The results reflect both the general urban dynamics of Turkey and the distinctive geographical, economic, and political decisions specific to Bursa.

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TABLE 3-3: DISTRIBUTION OF GREENHOUSE GAS INVENTORY IN BURSA PROVINCE

Inventory Distribution of Bursa Province	tonCO2e	%
Housing, Electricity + Fuel	2.612.599	20
Commercial & Governmental, Electricity + Fuel	1.246.171	10
Industrial, Electricity + Fuel	4.072.530	32
Industrial Process Emissions	604.662	5
Energy Production Facilities	838.290	7
Enteric Fermentation and Fertilizer Management	769.007	6
Transportation Options + Bus Station + Airport	2.490.554	19
Solid waste	85.951	1
Wastewater Treatment	105.381	1
Total	**12.825.146**	**100**

The emission data summarized in the table above are schematically shown in Figure 3.2 below.

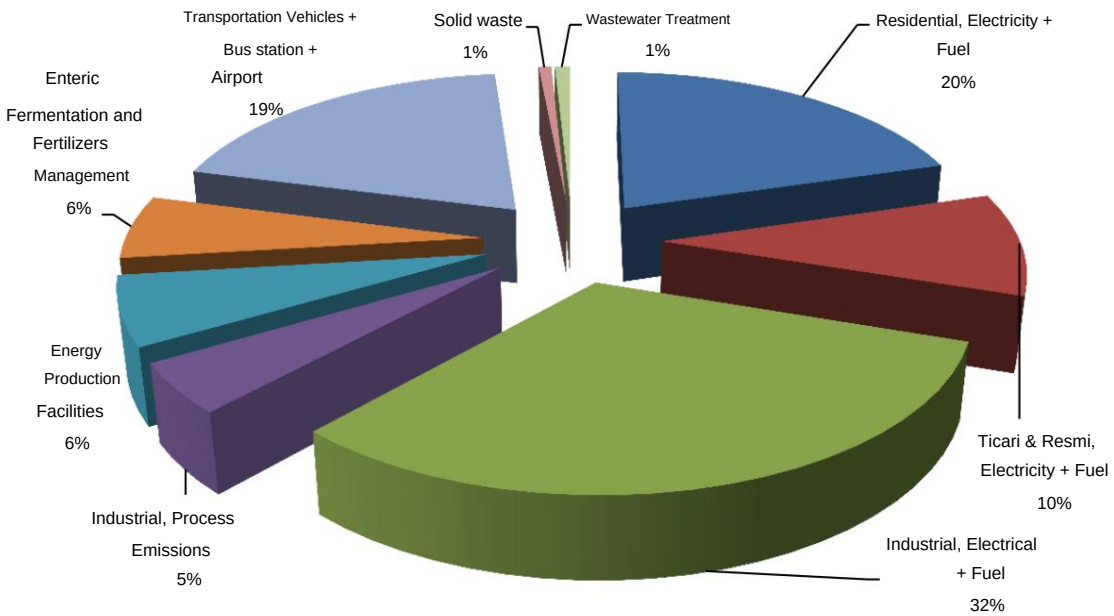

FIGURE 3-2: DISTRIBUTION OF URBAN GREENHOUSE GAS INVENTORY IN BURSA PROVINCE 2014, %

As highlighted, energy consumption from industrial activities within Bursa's borders (including the smelting industry) accounts for approximately 32% of total emissions. The high rate of industrial activity relative to its population leads to this result, primarily concentrated in Organized Industrial Zones (OIZs).

The increasing employment figures are also leaving their mark on the city's main transportation network. Residential energy consumption and...

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Emissions from transportation are calculated at similar rates of 20% and 19%, respectively. Outside of these categories, Bursa's two major sources of emissions are those from energy use in non-residential buildings and, uniquely in Bursa, emissions from fossil fuel-based power generation. As can be seen in the inventory data, their approximate shares are 10% and 6%, respectively. Significant power generation from fossil fuel sources takes place in the city. The Bursa city inventory only includes greenhouse gas emissions from facilities that generate electricity for their own industrial consumption (6%). Facilities generating energy for the grid are not included in the inventory as they are considered within the electricity emission factor. Furthermore, greenhouse gas emissions from the cement process in the city constitute 5% of the city inventory.

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4. BURSA CLIMATE CHANGE ACTION PLAN

Bursa is a city with deep historical roots and significant importance in terms of industry, trade, and tourism. Research indicates that the Bursa region has been home to various settlements since 4000 BC. Throughout history, both in antiquity and during the Ottoman era, Bursa has always been a city with intense relations with the outside world, and its economic structure has been heavily influenced by changes in other parts of the world. In the Republican era, starting in the 1960s, Bursa began to industrialize intensively, and from 1980 onwards, it regained its historical role as one of Türkiye's important export centers, adopting a path of industrialization based on foreign trade.

Bursa, Türkiye's fourth largest city, is a major player in the automotive, textile, machinery, and food industries. Historically, it is said that the first towel production took place in Bursa, and towel production and export continue to this day. Silk production and knife making, which once made Bursa world-renowned, have almost disappeared in recent years. It is famous for its thermal springs, Uludaÿ mountain, chestnut candy, peaches, and towels. The Bursa Organized Industrial Zone, established in 1961 as Türkiye's first organized industrial zone, and the later-formed Demirtaÿ Organized Industrial Zone, as well as the areas around the ÿzmir and Ankara roads, are the areas with the highest concentration of industrialization in Bursa. Automotive manufacturing companies in Bursa produce automobiles, buses, train wagons, and their spare parts, selling them both domestically and internationally. Tofaÿ-Fiat, Oyak-Renault, and Karsan automobile factories are located in Bursa. In addition to these large factories, there are thirteen Organized Industrial Zones encompassing various sectors, and work is underway on establishing three new Organized Industrial Zones.

The furniture industry operates in the Organized Industrial Zone of ÿnegöl District, and many famous furniture companies are located here. Many domestic textile brands in Türkiye have their factories in Bursa. Furthermore, Bursa, which is one of the most developed cities in Türkiye in terms of the textile industry, is home to the Bursa International Textile and Trade Center. Economically, Bursa represents an active and guiding force in the development and impetus of the Turkish economy. With its contributions to the development of the national and regional economy, the provision of foreign exchange through exports, and the strengthening of industrial infrastructure, Bursa exhibits great economic dynamism.

Bursa ranks 4th in terms of the added value it provides to the national economy, after Istanbul, Kocaeli, and Izmir.

The distribution of urban greenhouse gas emissions in Bursa is compared with Türkiye's overall economic situation since the 1980s. It clearly reflects the nature of urban development as it emerges from its dynamics. Migration, urban rent, rapid automobileization, and the encouragement of a credit-based consumer economy place significant pressure on the city. Bursa's current urban dynamics and problems have been identified in sufficient detail through numerous reports, congresses, and meetings prepared, collected, and compiled by the city's stakeholders, primarily the local government (see References).

The local government has prepared a short-term and long-term plan for urban development, in line with contemporary standards. Two crucial documents should be highlighted regarding implementation: **the 1/100,000 Environmental Planning Map, prepared with a target year of 2030, and the Bursa Transportation Master Plans.** Implementing a modern urban transportation system, compatible with the urban development plan that will regulate the city's long-term development, is the only way to address existing problems through planning.

In cities around the world threatened by climate change, resource scarcity, and adverse and sudden climate events. Contemporary urban management requires the integrated planning of energy flows and urban development. Climate

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Climate Change Action Plans (CCAPs) are indispensable planning and management tools, primarily for recording, monitoring, and reducing urban energy and greenhouse gas intensities in the long term. Their integration with long-term urban planning related to zoning and transportation allows for the articulation of the city's vision in various sub-fields by increasing stakeholder participation. The outward-facing elements of Bursa's urban economy, primarily the industrial and agricultural production sectors, make the city's energy and greenhouse gas intensities 'exceptional'. Conversely, they also point to 'extreme' areas where a low-carbon economy can be nucleated. The rapidly decreasing costs of renewable energy sources, the high spatial and sectoral concentration of Bursa's industry, the high potential for bio-based energy production in Bursa, and the urban stakeholders who are committed to the city's future, create significant synergy for sustainable urban development. 'Climate Change Action Plans' provide local governments with an important assessment tool by revealing and prioritizing all resources, potential uses, and applications.

TABLE 4-1: ENERGY CONSUMPTION EXPECTED TO BE REDUCED WITHIN THE SCOPE OF BURSA IDEP (ENERGY DEVELOPMENT PROJECT)

	MWh	tCO2e
Energy Consumption in Buildings, Equipment/Facilities and Industries	**22.197.338**	**7.929.941**
Municipal Buildings & Facilities	128.354	52.897
Houses	8.241.503	2.612.599
Other buildings and facilities outside of the Municipal Buildings	3.341.458	1.130.540
Industry	10.361.932	4.072.930
Municipal Street Lighting	124.091	61.375
Energy Consumption in Transportation	**9.374.422**	**2.491.541**
Municipal Vehicle Fleet	43.109	11.697
Public Transportation: Municipal Buses + Air Transportation	257.787	69.969
Public transportation: Metro + Tram	42.057	20.801
City Vehicles	8.909.044	2.356.063
Transit - Bus Station	101.674	27.610
Aviation	20.750	5.401
Other Emissions		**1.565.373**
Solid Waste Disposal		85.951
Wastewater Treatment		105.381
Fugitive Emissions		372
Industrial Process Emissions		604.662
Agriculture, Livestock, Land Use		769.007
Energy Production	**4.143.326**	**838.290**
Fuel Consumption for Electricity Generation	4.143.326	838.290
Total	**35.715.085**	**12.825.146**

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Bursa's urban greenhouse gas inventory, calculated by determining emissions under various categories, totals **12.8.** The figure has been determined as **millions of tons of CO2e .** The "Bursa Climate Change Action Plan" has been prepared based on these values, and targets and actions for emission reduction by 2030 compared to 2014 levels have been determined.

CURRENT SITUATION AND POSSIBLE FUTURES

Based on the information provided in the 2030 1/100000 Environmental Planning Plan prepared for Bursa province...
The population of Bursa province is expected to reach approximately 3,362,000 by 2030, representing an increase of about 21%.
If current trends continue, urban greenhouse gas emissions in Bursa are projected to reach the levels shown in Figure 4.1.
It is predicted that it will follow a trend as shown.

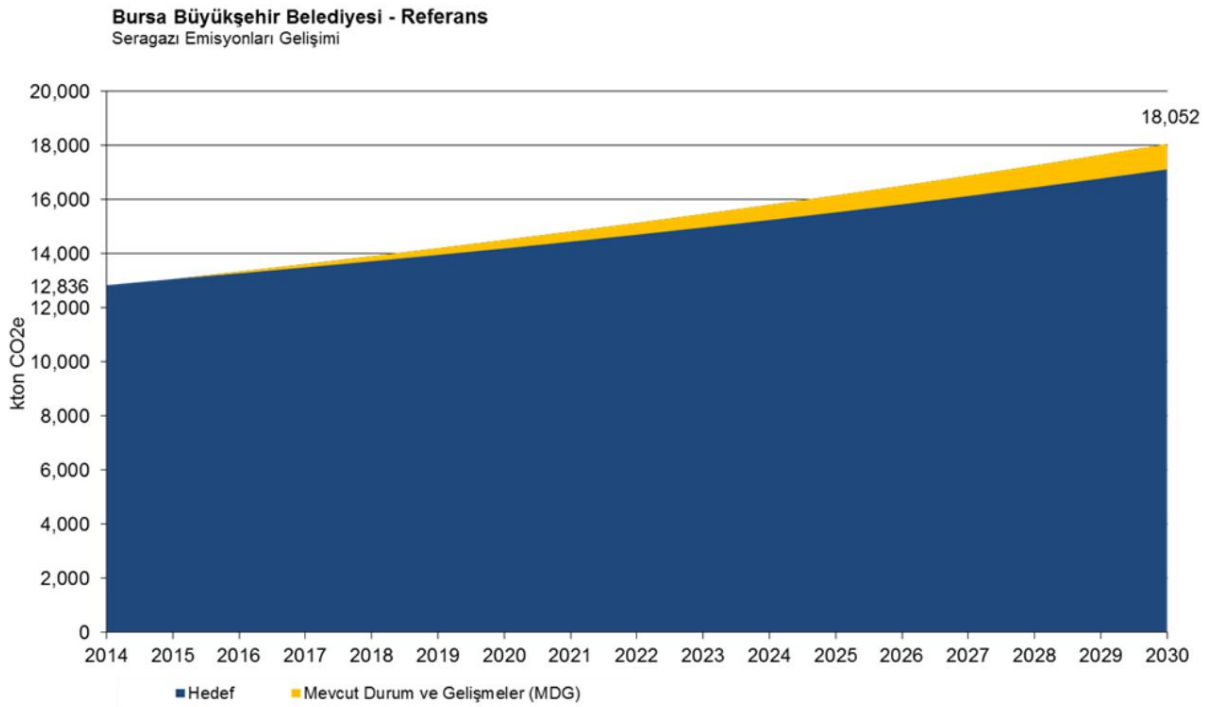

FIGURE 4-1: BURSA GREENHOUSE GAS EMISSION ESTIMATES, 2030

Future projections have been calculated using data such as population and sectoral trends obtained from reports and studies of the Bursa Eskiÿehir Bilecik Development Agency (BEBKA) and Bursa Metropolitan Municipality (BBB).
However, there is also a 'natural' trend of increasing energy efficiency in Türkiye, driven by technological advancements, legislation, and economic dynamics. For example, the government's official "Energy Efficiency Strategy Document 2010-2023" aims for a 15% reduction in energy intensity in the industrial and service sectors, an average of 15-30% in the building stock, and EU norms for household appliances and vehicles (a 3-4% annual emission reduction for automobiles).
The goal is to reduce energy consumption in household appliances by 30% by 2020.
Public institutions have been instructed to achieve a 20% energy saving by 2023. In light of the projections of official state institutions and developments in energy efficiency in Turkey's recent history, an average energy efficiency gain of 7% compared to 2014 levels by 2030 is considered a safe value within the scope of the BÿDEP study. This 'natural' decrease in energy consumption will bring Bursa's urban emissions to 17,119 ktons of CO2e by 2030, according to the projection for 2016, the year in which the measures will begin to be implemented .

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The study is based on city-scale greenhouse gas emissions, and future projections regarding energy consumption are made by considering various strategic plans related to the city. Recent efforts by Bursa have been very useful in this regard. In particular, the "Bursa 1/100000 Scale Provincial Environmental Planning Plan" prepared by the Bursa Metropolitan Municipality and the Bursa Provincial Special Administration, and the analysis reports prepared for this plan, as well as the "Bursa Metropolitan Municipality Main Transportation Plan," are the primary resources utilized.

Based on the projected increases in urban strategic plans (population, industry, etc.) since 2015, the year the report was prepared, energy consumption and greenhouse gas inventories have been projected for each year. As shown in the table below, the projected savings amounts resulting from possible reduction measures/actions have been determined year by year. The reduction rates presented in the report are the final reduction amounts achieved in 2030. The potential reductions in different sectors have benefited from the outputs of studies in Türkiye, particularly in the field of energy efficiency, in addition to the "general" approaches accepted in the international literature. For example, the total impact of interventions to increase energy efficiency in the building stock in Türkiye will undoubtedly be very different from those in Germany, for instance, due to differences in starting points. The cost and duration of interventions will also vary from country to country. The average impact of various improvements in urban transportation on transportation emissions has also been calculated using values from various reports prepared in this field. While the calculation methods used for urban greenhouse gas emissions have become increasingly similar in recent years, the debate continues regarding whether assumptions made for "developed" country cities may not be applicable to "developing" country cities. In "developing" countries where the pace of urban infrastructure renewal and expansion cannot keep pace with population growth, it has been suggested that increases in service units (e.g., increases in rail transport distances) should be based on different parametric assumptions. In Türkiye, increased research in this area, addressing differences and uncertainties in calculation methods, will improve the accuracy of both urban emission inventories and reduction estimates.

Most of the mitigation measures, starting in 2016, have been increased incrementally over the years, reaching the percentage values specified in the relevant sections by 2030. When all these mitigation results are added together, although a significant reduction compared to 2014 has not been achieved, it can be concluded that a 31% reduction is achievable by 2030 according to the As It Has Been, As It Will Be (BAU) scenario.

4.1 ACTION PLAN SCOPE AND GREENHOUSE GAS REDUCTION MEASURES

The Bursa Climate Change Action Plan consists of 7 main sections: urban development, service sector, renewable energy, transportation, solid waste and wastewater management, agriculture-livestock, forestry, and awareness-raising actions.

Regarding the specified topics, the current situation was first assessed, and strategies were developed to reduce the identified greenhouse gas emission sources. Care was taken to ensure that the determined strategies were consistent with other plans made at the local and national levels.

Under the heading of Urban Development and Built Environment, internationally accepted and highly feasible measures to reduce energy consumption in residential, municipal, and other commercial buildings in the city were identified, and achievable targets were determined by considering national strategic plans and the decisions taken at the workshop.

Under the transportation heading, the objectives outlined in the city's Transportation Master Plan have been largely taken into account.

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Bursa is known to have greater potential in renewable energy than, for example, Germany, which widely uses solar energy for electricity generation. Due to the large number of industrial buildings, there are suitable areas, especially for applications on buildings.
Bursa's prominence as a leading province in agriculture and livestock farming also strengthens its potential in biomass and biogas.

The fact that solid waste is largely handled through regulated landfills in the city and that energy is obtained from landfill gas significantly contributes to reducing greenhouse gas emissions. Measures have been planned to reduce greenhouse gas emissions, which are expected to increase with the projected population growth in 2030.

The energy efficiency measures that industry, which accounts for a significant share of the city's energy consumption, can take are quite extensive. The expertise and goals of large, international organizations will play a significant role and provide guidance in reducing energy consumption.

Bursa is not only an important industrial city, but also a very important agricultural city. Agricultural irrigation, intensive fertilizer use, and the high amount of agricultural and animal waste create significant potential for the city.

Through awareness campaigns and information points that can be organized in cooperation with relevant institutions, and with the guidance and example provided by Bursa Metropolitan Municipality, the public will be informed about energy efficiency and renewable energy.

4.1.1 URBAN DEVELOPMENT – BUILT ENVIRONMENT

According to the 2012 National Greenhouse Gas Inventory; 70% of national CO_2 emissions (309 million tons CO_2e)
This is due to energy. According to the Current Situation (BAU - 'Business as Usual' or "As It Has Been, So It Will Be") scenario, the energy consumption of the building sector, currently 28.3 million TEP, is estimated to reach 47.5 million TEP (tons of oil equivalent) by 2030, indicating a doubling of CO_2 emissions. On the other hand, the building sector offers significant opportunities in terms of cost-effective emission and energy saving potential. In its First National Communication submitted to the UNFCCC (United Nations Framework Convention on Climate Change), the Government stated that investing in energy efficiency is more cost-effective than using renewable energy in reducing emissions.5

Population growth and rapid urbanization are increasing the need for housing, especially in large cities. According to the Turkish Statistical Institute's (TÜÿK) 2000 building census, the number of buildings increased by 78% from 4.3 million in 1984 to 7.8 million in 2000, while the number of houses increased by 129% to 16.2 million according to the same year's data. According to the 2000 building census, the area of residential, commercial, and public buildings corresponds to 913 million m² , of which approximately 400 million m² is estimated to be heated.

In our country, a construction policy has been followed that is based on meeting the housing needs in an unplanned manner due to population growth and migration. Buildings have been constructed with the approach of keeping initial investment costs low, and energy and maintenance costs throughout the lifespan of the buildings have not been taken into consideration. Therefore, energy costs for heating and cooling constitute a burden on the operating expenses of commercial buildings and public institutions, and on family budgets, with energy prices increasing every day.

5. Development of Turkey's Climate Change Action Plan Project: Buildings Sector - Current Situation Evaluation Report, Tülin Keskin, August 2010

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In the building sector, renewable energy sources such as solar, geothermal, wood, and plant and animal waste account for 21% of consumption. Plant and animal waste, traditionally used primarily for heating in rural areas, is gradually being replaced by natural gas and coal. While heating in the building sector is provided by fuels, electricity is used for cooling and electrical appliances, lighting, and other services. Electricity consumption has the second highest share at 24%, after natural gas (26%).

Even when compared solely in terms of current construction standards, the building stock constructed in our country before 2000 consumes at least twice as much energy as it would under today's regulations. The General Directorate of Renewable Energy (formerly the Electricity Works Survey Administration - EIE) states that the energy efficiency potential in buildings is 35%, and estimates that by 2023, thermal insulation in 10 million homes could save 2400 GWh of electricity for cooling and 2.3 million TEP of fuel for heating.

The Bursa Eskiÿehir Bilecik Development Agency (BEBKA) has "Livable Spaces, Sustainable Environment" as one of the main axes of its 2014-2023 Regional Plan. This development axis aims to bring the distribution and arrangement of settlements, the quality and functionality of working and living spaces, the harmony of land uses, and environmental impacts into line with the current income and development levels.
The objectives include: ensuring basic quality of life standards in all urban and rural settlements to reduce regional imbalances; minimizing limitations arising from spatial disadvantages for inclusive development and equal opportunities; organizing production that considers the competitiveness of regions to ensure a more balanced distribution of production across the country; transforming cities into livable spaces that manage their risks; ensuring urban transformation is a systemic application tailored to needs; restructuring local administrations based on governance principles; enriching rural area policies and practices; protecting environmental quality; ensuring the harmony of economic growth with social and environmental factors; determining the economic value of natural resources and developing environmental standards in production and consumption with a competitiveness and green growth approach; ensuring the sustainability of climate change and biodiversity; and incorporating disaster management and pre-disaster risk reduction measures into settlement planning and zoning processes.

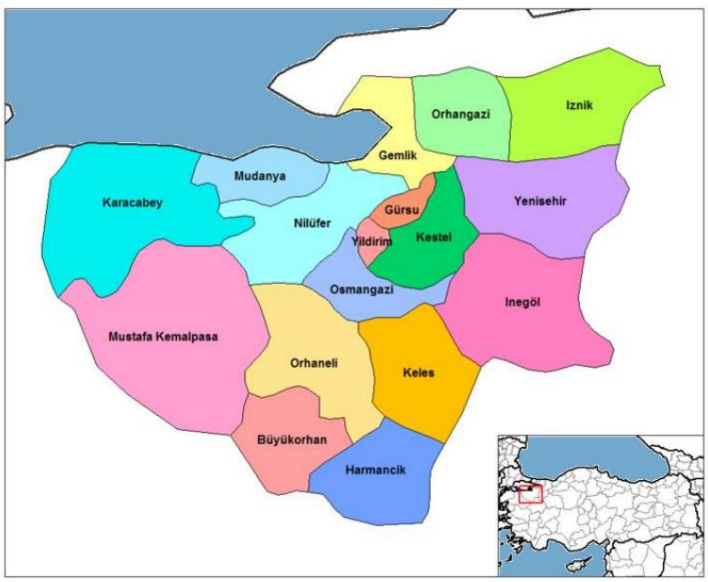

FIGURE 4-2: BURSA PROVINCE CENTER AND ADMINISTRATIVE UNITS

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Bursa province, in particular, experienced rapid population growth after 1980 due to industrial development and migration. A significant portion of the population growth in the region is due to migration from outside the region. With a net migration rate of 4.23 per thousand, it is possible to say that a significant portion of the population increase in the region is driven by migration from outside the region. Additionally, as a result of migration caused by increased employment due to developing industries, Bursa can be considered the province in the TR41 region that receives the most migrants and has the highest population density.

When comparing population indicators across Turkey with those of the TR41 region, it is observed that although the region's population growth is above the national average, its fertility rate remains significantly below the national average.

According to 2014 Turkish Statistical Institute (TUÿK) data, the population of Bursa Province is 2,787,539. Of the total population, 1,394,715 are male and 1,392,824 are female. It is the fourth largest city in terms of population, after Istanbul, Ankara, and Izmir. While the average population growth rate in Türkiye is 13.4 per thousand, it is 17.0 per thousand in Bursa.

TABLE 4-2: DEMOGRAPHIC INDICATORS FOR 2013

	Türkiye	TR41	Bursa
Population share	100	4,9	3,6
Population Density (number of people per km²)	100	-	263
Population growth rate (‰)	13,7	18,2	19,5
Age Dependency Ratio	47,7	45,4	42,9
Net migration rate (‰)	-	5,4	5
Employment rate (%)	45,9	46,9	48
Unemployment rate (for ages 15 and over)	9,7	7,0	6,6

Source: Turkish Statistical Institute (TUÿK), 2013

In Bursa, the most populous province in the TR41 region, 44% of the population is registered in other provinces. 56% of the total population is registered in Bursa.

TABLE 4-3: BURSA PROVINCE POPULATION PROJECTION, BEBKA REGIONAL PLAN, 1/100000 SCALE BURSA PROVINCE ENVIRONMENTAL PLANNING PLAN, BURSA INTEGRATED WASTE MANAGEMENT PLAN

Million	2015	2018	2020	2023	2030	2040	2050
BABY	2.802,0	2.909,0	2.977,0	3.073,0	-	-	-
Environmental Planning Map	2,781.5	2,888.8	2,960.0	3,079.5	3,362.2	3,699.5	3,970.2
Bursa Integrated Waste Management Plan – UNDP Method	2.779,9	-	2.994,8	-	3.342,1	3.649,6	3.933,5

Bursa ranks first in the region and fourth in the country in terms of social and economic development level, population size and growth, economic activities, regional services, infrastructure, and transportation facilities. The city, which is rapidly developing in terms of population and economy not only within the region but also nationwide, has taken significant steps towards becoming a metropolis.

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The 2030 1/100,000 Scale Environmental Planning Study prepared by Bursa Metropolitan Municipality.

In the synthesis study on the natural and cultural values and soil characteristics of Bursa province, prepared by the Natural Structure working group, which is among the groups involved, four basic classes were determined to guide conservation and usage decisions and spatial function definitions:

1. Protected Areas Defined by Law Due to Their Natural Values,
2. Protected Areas Whose Use is Restricted by Law Due to Their Natural Value,
3. Areas at Risk from a Geosciences Perspective,
4. Other Areas.

Areas to be protected for legal reasons include: absolute-short-distance protection zones of drinking water basins, floodplains, reedbeds-marshes, dune-beach areas, protection zones of hot, mineral, bottled spring water, drinking water sources and wells, **areas whose use is restricted for legal reasons, and** medium-distance protection zones of drinking water basins. **Areas deemed unsuitable from a geological perspective** include alluvium, artificial fill, active landslides, areas with slope gradients >50 degrees, Miocene semi-consolidated areas, passive-potential landslides, flows, and areas with slope gradients between 30-50 degrees. In line with the above classifications, it is observed that a large portion of the existing and planned transportation infrastructure areas in Bursa are located either in areas protected by law due to their natural values or in areas deemed unsuitable from a geological perspective.

[6]

The 2030 1/100,000 Scale Environmental Planning Synthesis Report prepared by Bursa Metropolitan Municipality makes the following observation regarding the impact of all these developments on the urban form:

"...In parallel with the continuously increasing population and developing economy of Türkiye and the Marmara Region, the province of Bursa is also constantly growing and developing. Geographically located in the very center of the three major cities (Istanbul-Ankara-Izmir), Bursa has the character of a true metropolitan city with its dynamic population and constantly growing industrial, agricultural and tourism sectors. This growth also brings with it traffic and transportation problems."

It is thought that the problems may worsen if the necessary planning and measures are not taken in the short and medium term.

Adopting a sustainability principle as the fundamental approach in the Environmental Planning Scheme, the urban area has been divided into Absolute Protection Areas, Priority Protection Areas, and Habitable Areas. The map in Figure 4.3 shows the division of the city according to the Plan's analysis criteria.

HOUSING NEEDS AND DEMAND ANALYSES

Considering the population projection data for 2020 and 2030 made by the group of social, economic and spatial structure analyses for Bursa in general, the housing need in these years was calculated using the indicator of “10 housing units that should be produced per 1000 people per year” (UN Habitat II(1996))7 . According to the table, in the period 2014-2030, the population of Bursa will be 580 thousand.

It is assumed that there will be an increase. The number of houses needed for the increased population during this period has been calculated by dividing it by the household size (3.71 people), and approximately 160,000 houses are needed for the additional population alone.

6. *Bursa 2030 1/100,000 Environmental Planning Plan, Synthesis Report, Bursa Metropolitan Municipality 2012*
7. *Bursa 2030 1/100,000 Environmental Planning Map,* Environmental Planning Housing and Social Facilities Report, *Bursa Metropolitan Municipality 2012*

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It has been determined that housing needs to be produced. In addition, there are houses that need to be built for the purpose of legalizing, improving, and renewing the existing housing stock for various reasons, and the number of these houses is 9,000-11,000 per year.

Initially, BÿDEP primarily prioritized reduction measures to increase the energy efficiency and renewable energy use of the existing building stock, but it also developed proposals for new building stock in the 'habitable' area envisioned by the Plan.

The energy consumed in buildings or the existing building stock is one of the most significant sources of energy consumption and greenhouse gas emissions, not only in Bursa but in all cities worldwide. Due to its geographical location, Bursa is a city where heating energy needs account for the largest share of energy consumption in the building stock.

The spatial distribution of population growth rates in the last decade provides insight into how the population will be distributed in the city in the future. Accordingly, it is estimated that population growth will continue in the districts of Nilüfer, Osmangazi, Yÿldÿrÿm, Mudanya, Gemlik, Gürsu, and ÿnegöl; that the population increased in Kestel and Orhangazi districts in 2020 but will begin to decrease in 2030; and that the population will decrease in Mustafakemalpaÿa, Karacabey, ÿznik, Yeniÿehir, Orhaneli, Büyükorhan, Harmancÿk, and Keles districts.8

When existing residential areas are examined across the province in terms of plans, it is seen that 60.11% (13,376.80 hectares) of the total residential area of 22,254.94 hectares is built within the boundaries of the zoning plans, 3.11% (693.31 hectares) is built outside the boundaries of the zoning plans, and 36.78% (8,184.84 hectares) are areas planned as residential within the boundaries of the zoning plans but are not built upon.

When existing residential areas are examined in terms of planning, both at the district level and in terms of their proportional distribution within their own building stock;

• In the districts of Nilüfer, Osmangazi, Yÿldÿrÿm, Gürsu, Kestel, Mustafakemalpaÿa, Karacabey, Orhangazi, ÿznik, and Yeniÿehir, residential areas built within the planning zone exceed 50%.

• Gemlik, Yÿldÿrÿm, and Gürsu districts have more residential areas built outside of planned development plans compared to other districts.

• There are no residential areas built outside the planning zone in the districts of Kestel, Karacabey, Orhangazi, ÿznik, Yeniÿehir, Orhaneli, Harmancÿk, and Keles.

8. *Bursa 2030 Environmental Planning Map, 1/100,000 Scale, Bursa Metropolitan Municipality, 2012*

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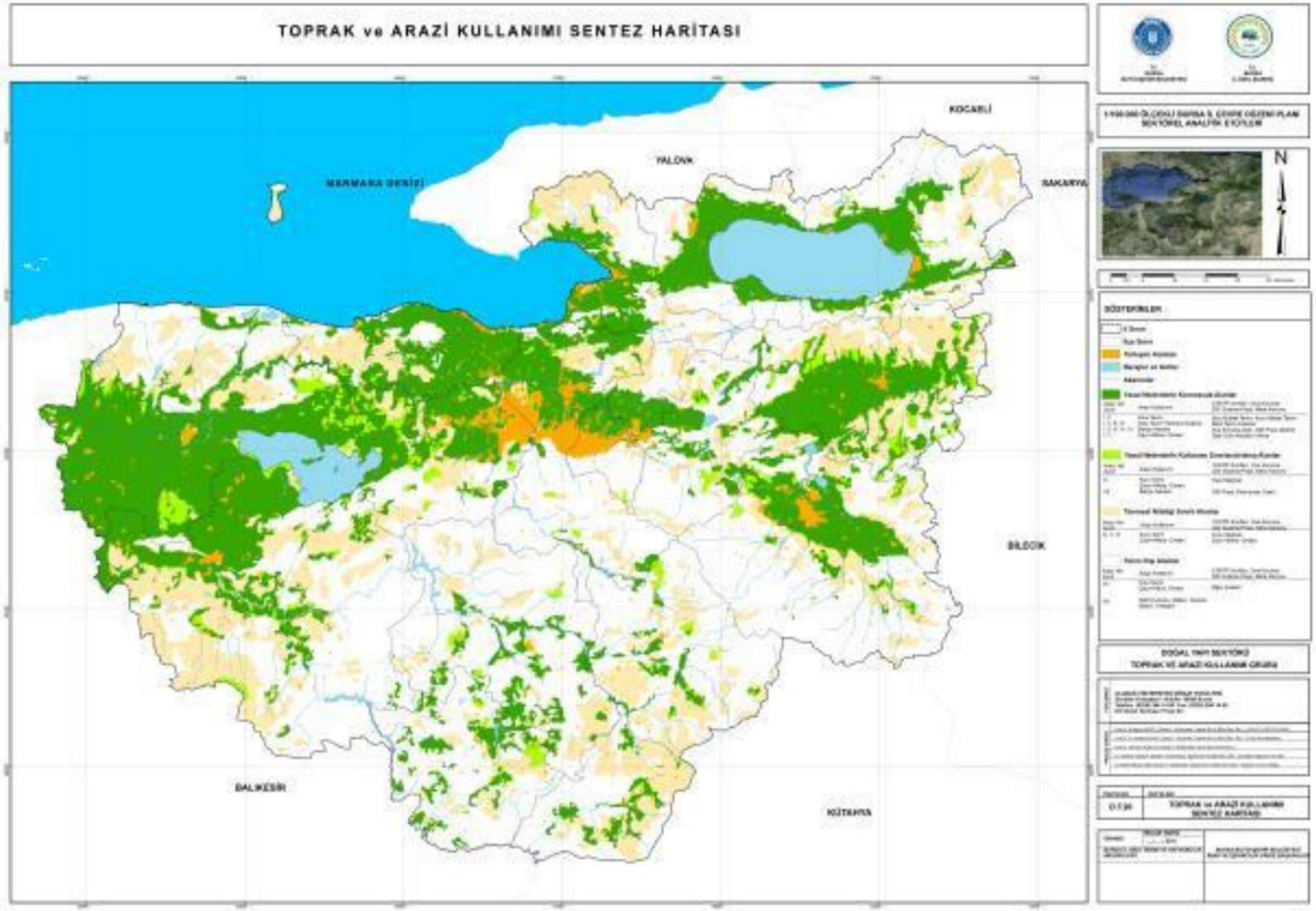

FIGURE 4-3: BURSA METROPOLITAN MUNICIPALITY, 1/100000 ENVIRONMENTAL PLANNING MAP, SOIL AND LAND USE SYNTHESIS MAP.

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In Bursa, 34.21% (4,813.46 ha) of the total residential area consists of irregularly developed residential areas according to the existing zoning plan, 13.79% (1,943.36 ha) consists of areas where a rehabilitation zoning plan has been implemented, and 4.92% (693.31 ha) consists of residential areas built outside the implementation zoning plan. 0.37% (52.49 ha) of the total residential area in Bursa consists of areas developed as slum prevention zones, 50.1% (704.49 ha) consists of residential areas within urban protected areas, 7.27% (1,023.25 ha) consists of mass housing areas, and 34.40% (4,839.76 ha) consists of regularly developed residential areas according to the existing zoning plan.ÿ

The highest percentages of built-up areas in total residential areas are found in the districts of Gürsu (96.20%), Yÿldÿrÿm (87.51%), Karacabey (84.48%), and Osmangazi (75.88%). These districts have very limited development potential within the framework of the current plan. In contrast, districts with high percentages of unbuilt residential areas, such as Harmancÿk (69.24%), Büyükorhan (64.07%), Keles (58.90%), and ÿnegöl (55.00%), have high development potential within the framework of the current plan.

An examination of the regular and irregular development status of existing residential areas in the districts revealed that Yÿldÿrÿm district (76.19%) and Osmangazi district (54.46%) have the highest rates of irregular residential areas. It is observed that these districts have problems requiring solutions regarding spatial standards in their residential areas.

When comparing the building density ratios in residential development areas in 1/25,000 scale master zoning plans;

It was determined that the highest level of construction occurred in the central planning region (23.66%), while there was no construction in the eastern, northern, Yeniÿehir, and Karacabey planning regions. When the existing residential areas included in the 1/25,000 scale master zoning plans were examined in terms of their saturation rates with housing;

- It has been determined that the eastern planning region is 100% saturated with housing, the central and Gemlik planning regions are over 90% saturated with housing, the western, Mudanya and Karacabey planning regions are over 80% saturated, while the Yeniÿehir and ÿznik planning regions are half empty.10

TABLE 4-4: UNDEVELOPED RESIDENTIAL AREAS AND ESTIMATED POPULATION BY DISTRICTS

Districts	Undeveloped residential areas (ha)	Population calculated for the undeveloped area.
Lotus	**1926,88**	**351.119**
Osmangazi	**948,36**	**187.803**
Lightening	336,72	88.366
Young	674,69	65.323
Gemlik	509,97	70.404
Gursu	8,6	2032
During	105,35	22398

9. *Bursa 2030 1/100,000 Environmental Planning Plan, Synthesis Report, Bursa Metropolitan Municipality 2012*
10. *Bursa 2030 Environmental Planning Plan, 1/100,000 Scale, Synthesis Report, Bursa Metropolitan Municipality 2012*

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Inegöl	**1.025,60**	**187.004**
M. Kemalpaÿa	399,91	56.706
Karacabey	58.25	13.556
Orhangazi	132,18	19.334
Iznik	162,46	31.099
Yeniÿehir	138,21	50.778
Orhaneli	120,09	11896
Büyükorhan	96,72	3.650
Harmancÿk	54,21	4287
Keles	39,51	4452
Total	**6.737,72**	**1.170.207**

PROBLEMS RELATED TO CONSTRUCTION

Problems related to construction are generally similar to those seen throughout Türkiye.

These include:

- Inadequate building quality, lack of regulation of housing areas and the housing sector
- Masonry buildings predominate in the building stock throughout Bursa province.
- A certain percentage of the building stock in Bursa consists of buildings completed before 1929 that require renovation and maintenance; approximately 6% of the building stock is over 50 years old.
- Discrepancies between the current situation and plans, and a high rate of illegal construction. being.
- The presence of buildings constructed using the masonry system in neighborhoods that developed without planning during the 1970-1990 period.
- Spread of residential areas into the plain.
- Ignoring risk areas in housing site selection (fault lines, riverbeds, alluvial areas, rockfall and landslide areas, areas with swelling, settlement, and liquefaction potential, excessively steep areas, floodplains, etc.).
- Construction under high-voltage power lines and in landfill areas.
- Insufficient preservation of the historical fabric.
- Mass housing projects carried out by the Mass Housing Administration in the city center of Bursa. The applications are inappropriate.
- Excess and unused housing stock.
- Stoves are the most common type of heating in the districts and towns of Bursa.
- High building density and poor environmental quality
- High building density (especially in the central districts and ÿnegöl) and the resulting decrease in livable area standards.
- Low standards of the existing housing stock (especially where there is illegal construction) (low building and environmental quality in the regions).

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ÿ The proximity of industrial zones and residential areas (air pollution, facilities harmful to health) (Gemlik, Kestel, Demirtaÿ, Nilüfer, Osmangazi).

Overall, it is observed that the population of Bursa is concentrating and increasing in the districts within the former metropolitan municipality boundaries and in the ÿnegöl district, while the population is decreasing in the mountainous districts and those with a more dominant rural character. If the assumptions regarding population projections continue, it is expected that the new housing projects will be concentrated within the boundaries of the Bursa Metropolitan Municipality and in the ÿnegöl district.

MITIGATING MEASURES IN BUILDINGS

Objective B1: *To reduce consumption in existing buildings in Bursa province through energy efficiency applications.*

Objective: *To prevent heat loss in winter and heat gain in summer in residential buildings, reduce fuel consumption, and lower greenhouse gas emissions.*

Stakeholders: *Homeowners and tenants, insulation material manufacturers, installation companies, Energy and Ministry of Natural Resources (ETKB), financial institutions, professional organizations, Thermal, Water, Sound and Fire Insulation Contractors. Union (IZODER), Energy Efficiency Association (ENVERDER)*

Objective B1: Energy-efficient renovations in existing homes.
Action B1.1: Thermal insulation in existing housing
Action B1.2: Renewable energy applications in existing residential buildings
Action B1.3: Use of energy-efficient lighting systems (energy-saving LED lighting) in existing residences.
Action B1.4: Heating approximately 100,000 homes with district heating.

Action B1 .1	**Thermal insulation in existing homes.**
Available Situation	Electricity subscriber numbers in Bursa province show that there are over 1.1 million residential subscribers. Energy consumption in residential areas accounts for 23% of all energy consumption in Bursa and 20% of emissions (8,241,503 MWh and 2,612,599 tCO2e). Like other buildings, residential buildings are also required to obtain an Energy Identity Certificate by 2017, in accordance with the Energy Efficiency Law and the Regulation on Energy Performance in Buildings, which came into force in 2008. According to research conducted by the Ministry of Public Works and IZODER (Izmir Chamber of Insulators), the number of buildings with thermal insulation, including those constructed after 2000 and conforming to the TS 825 standard, is only 20% nationwide in Türkiye. It does not exceed that limit. It can be assumed that the same rate applies to Bursa as well. In addition to raising public awareness, various funding opportunities need to be created to promote this issue. The distribution of funds received from abroad has already begun.
Activities	It is projected that 30% of the existing buildings within the city will have their facade, roof, and window insulation completed by 2030. As a result of these activities, the relevant

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/Steps	It is predicted that residential buildings will see **a 5% energy saving in electricity and a 30% saving in heating fuels .** At the same time, it is predicted that coal consumption in residential buildings will decrease by 50%, and these buildings will switch to natural gas and other fuels (biomass, etc.).
Timing	2016 – 2030
Cost	An average house has 100 m2 of area to be insulated, and the cost is 50 TL/m2. Assuming the price is around this level, an estimated 5000 TL per house is projected. The total estimated cost is approximately 955 million TL.
Saving Quantity	In 2030, **29,093 MWh** of electricity, **395,488 MWh** of natural gas, and **1,456,912 MWh** of natural gas will be produced. It is projected that **a total of 1,881,492 MWh** will be saved from coal consumption, resulting in savings of **14,389 tons** of electricity, **80,086 tons** of natural gas, and **604,042 tons of...** **A total emission reduction of 698,517 tCO2e** is achieved from coal .
Investor	Building and/or Homeowners
Stakeholders	Financial institutions, insulation material manufacturers, application companies, Municipal Planning Department, District Municipalities
BBB's contribution	The municipality cannot be expected to be an investor in increasing the energy efficiency of housing. However, the municipality can provide guidance by bringing together relevant stakeholders. Financial institutions can be encouraged to develop joint financial solutions with different material manufacturers to offer citizens affordable financing options. If the municipality can allocate sufficient human resources, it can support financial institutions in monitoring the projects to be developed and ensuring their appropriate use.

Action B1.2: Implementation of renewable energy applications in residential buildings.

At the forefront of distributed renewable energy applications, particularly in Bursa, are photovoltaic and heat pump applications. After a brief period of stagnation, the PV technology market is growing rapidly, driving down prices. As previously mentioned, while significant legislative shortcomings have been addressed, it is anticipated that it will take time for newly privatized distribution companies to adapt to distributed photovoltaic applications. Conversely, it is predicted that the falling prices of the technology and the rising electricity prices in Türkiye will lead to more reasonable payback periods for PV applications in residential settings starting in 2017. The estimated rooftop applications for Bursa are detailed in Section 1.4 of the Renewable Energy Emission Reduction Projects.

Action B1.3: Implementation of energy-efficient lighting systems in existing residential buildings.

Action B1 .3	**The use of energy-efficient lighting systems in existing homes.**
Available Situation	Various studies conducted in Türkiye show that electricity consumption for lighting in homes is around 10-20% of total electricity consumption. Based on the number of residential electricity subscribers in Bursa province, it is projected to reach 75% by 2030.

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	It is estimated that residents can reduce their energy consumption for lighting by 50-80% and their total electricity consumption by 10% by switching to energy-efficient lighting systems. (It is assumed that 70% incandescent and 30% compact fluorescent lamps are used for lighting, in accordance with the reference residential building parameters defined in the Energy Performance Regulation for Buildings.)
Activities /Steps	It is estimated that replacing the most frequently used lighting fixtures in homes, and subsequently all of them, with LED lighting will result in **a 10%** saving in electricity consumption.
Timing	2017-2030
Cost	The approximate cost of 12 lighting changes per residence is 240 TL, totaling 76.8 million TL.
Saving Quantity	The goal is to reduce electricity consumption **by 163,426 MWh** and emissions **by 80,830 tCO2e .**
Investor	Homeowners, tenants
BBB Contribution	It should be informative and provide guidance.

Action B1.4	**District heating will meet the heating needs of 100,000 homes.**
Available Situation	Another issue whose importance is increasingly understood in Türkiye is that individual heating of residences is an incorrect practice in terms of energy efficiency. With the Energy Performance Regulation for Buildings, the use of central heating systems has been made mandatory in newly constructed buildings with a total usable area exceeding 2,000 m², and the conversion of buildings with central heating systems to individual systems has been made more difficult within the framework of Article 42 of the Condominium Law. **District heating systems** are large-scale heating systems that meet heating and hot water needs by transporting heat produced from one or more energy sources to heat users (industrial facilities, housing complexes, neighborhoods, cities, etc.) via pre-insulated pipe systems. Bursa province has many large facilities, such as cement factories. Their waste heat can be used to heat the surrounding residences. There are many studies worldwide on district heating systems that utilize biomass fuels as alternative fuels. There are many applications. To heat
Activities /Steps	100,000 homes with district heating, feasibility studies will first be necessary. Including district heating systems on the central government's agenda will accelerate steps in this area. Currently, TÜBÿTAK is conducting a study on utilizing waste heat from thermal power plants for buildings in the region.
Timing	2020 - 2030
Cost	
Saving Quantity	A decrease in energy consumption of **409,747 MWh** due to heating and hot water, **and 82,974** The goal is to reduce **CO2e** emissions by tons.

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Investor	District heating systems fall under the jurisdiction of Metropolitan Municipalities.
Stakeholders	Metropolitan Municipality, industrial establishments that produce waste heat, contracting firms, fund supplier organizations.
BBB's contribution	While district heating infrastructure was previously the responsibility of district municipalities, it has been the responsibility of the Metropolitan Municipality since the 2014 local elections, under the law also known as the Metropolitan Municipality Law. Therefore, Bursa Metropolitan Municipality can be a direct investor in this matter. The municipality is responsible for distributing the waste heat it purchases and/or produces to subscribers.
Risks	High initial investment cost, There may be logistical difficulties in obtaining the waste materials needed for biogas production.

Objective B2: *Energy-efficient planning of areas designated as new settlement areas in Bursa province.*

Objective: *To achieve low-carbon urban development by integrating energy efficiency and renewable energy sources into projects when rebuilding buildings that do not comply with earthquake regulations and designing areas for new settlements, resulting in homes that consume 40% less energy.*

Stakeholders: *BBB (Istanbul Metropolitan Municipality), Housing Development Administration (TOKÿ), urban and regional planners, Chamber of Architects, Ministry of Energy and Natural Resources, professional organizations, IZODER (Izmir Chamber of Commerce), ENVERDER (Izmir Development Agency), construction companies, financial institutions, various funding sources, development agencies.*

Objective B2: Energy-efficient planning of new settlement areas.
Action B2.1: Energy-efficient urban transformation in residential areas.
Action B2.2: Sustainable settlement design in a new settlement area

Action B2.1: Urban transformation area

Action B2.1	**Energy-efficient urban transformation in housing.**
Available Situation	One of the focus areas of the Bursa Metropolitan Municipality's Urban Planning and Development Services Unit is the planning and implementation of urban transformation. The 5-year strategic actions included in Focus Area 1 of the Bursa Metropolitan Municipality's 2015-2019 Strategic Plan are listed below. - Preparing Urban Transformation Concept Projects - Developing Mathematical Models for Urban Transformation - Implementing Urban Transformation Projects - Ensuring the Integration of Urban Transformation Projects with Zoning Plans - Preparing Urban Transformation Implementation Projects At the workshop held on September 10, 2015, it was
Activities /Steps	assumed that approximately 60,000 houses would be demolished and 100,000 houses would be built through urban transformation in parts of Gürsu, Yÿldÿrÿm, and Osmangazi districts. Building houses that utilize energy efficiently and integrate renewable energy systems from the design phase of the urban transformation area's project and planning studies will lead to significant gains in terms of energy efficiency.

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	It is predicted that energy consumption will be **40%** lower through insulation, efficient lighting, and passive measures (architectural design) .
Timing	The goal is to have all planning completed by 2019. It is projected that urban transformation will continue gradually from 2019 to 2030.
Cost	It is currently estimated that designing and constructing energy-efficient buildings in areas undergoing urban transformation will increase costs per apartment by 6%. The approximate cost per dwelling is around 6000 TL.
Saving Quantity	With savings of **95,802 MWh** of electricity and **417,577 MWh** of natural gas, the total **is 513,379 MWh.** The target is a total reduction **of 131,943 tCO2e ,** consisting of a **47,383 tCO2e** reduction in electricity emissions and **an 84,559 tCO2e** reduction in natural gas emissions .
Investor	Building owners, construction companies
Stakeholders	BBB, Ministry of Environment and Urbanization, contractors, financial institutions, relevant professional chambers, and auditing companies.
BBB Contribution	Changes can be made to the zoning plan notes in areas where the planner, guide, unifier, and licensing authority is in place.
Risks	High cost, lack of information.

Action B2.2: Sustainable settlement design in new residential areas

Action B2.2	**Sustainable settlement design practices in new residential areas / new construction areas.**
Available Situation/Purpose	To accommodate an estimated 600,000 new residents by 2030, nearly 200,000 new homes will need to be built. Some of these will be met through increased building height limits in urban transformation projects. The goal should be to construct energy-efficient buildings from the design phase onwards, incorporating renewable energy systems and integrating housing with urban public transportation systems. Furthermore, the Energy Efficiency Strategy Document published in 2012 includes the following clause: "The possibilities of utilizing renewable energy sources, cogeneration or micro-cogeneration, central and district heating and cooling, and heat pump systems in mass housing projects will be analyzed, and within the framework of the criteria to be determined by the ministry, these will be encouraged until the legislation within the scope of the action code SA-02/SH-01/ E-01, which is specified under the strategic objective of reducing the energy demands and carbon emissions of buildings; promoting sustainable, environmentally friendly buildings using renewable energy sources, comes into force."
Activities /Steps	The municipality's zoning plan notes and the Metropolitan Municipality's zoning regulations need to be revised. In order to incentivize building owners, measures such as increased building density (like the 0.5 increase in Bursa province), tax reductions, and fee reductions should be implemented.

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	methods can be applied. This project, a key outcome of the "Bursa Plans for a Sustainable Future" Workshop, is designed as a model and replicable example of a building stock and urban infrastructure area where new applications and technologies can be demonstrated, both for individual buildings and for the region as a whole. International best practice examples can be evaluated in the preparatory work for this project. A detailed plan and feasibility study should be conducted by examining international green building certification systems ("BREEAM Communities" and/or "LEED for Neighborhood Development") and newly developing domestic certification systems.
Timing	2021 - 2030
Cost	The improvements, which are expected to add 15% to the housing investment cost, are estimated to cost 15,000 TL per housing unit.
Saving Quantity	Because the impact of this issue is multifaceted, calculating the exact amount of savings is quite difficult.
Investor	Construction companies, landowners
Stakeholders	BBB, District Municipalities, Ministry of Environment and Urbanization, contractors, financial institutions, relevant professional chambers, architects, implementation companies
BBB Contribution	Planner, guide,
Risks	High cost, social acceptance.

Objective B3: *To reduce consumption in existing commercial buildings in Bursa province through energy efficiency applications. reduction*

Objective: *To prevent heat loss in winter and heat gain in summer in commercial buildings, reduce fuel consumption, and lower greenhouse gas emissions.*

Stakeholders: *Commercial building users, insulation material manufacturers, installation companies, Bursa Chamber of Commerce and Industry (BTSO), Ministry of Energy and Natural Resources, financial institutions, professional organizations, IZODER, ENVERDER, and the ministry responsible for all public buildings.*

Objective B3: Energy-efficient renovations in existing commercial buildings.
Action B3.1: Energy-efficient renovations (thermal insulation) in existing commercial buildings
Action B3.2: Energy-efficient lighting in existing commercial buildings.

Action B3.1	**Energy-efficient renovations (thermal insulation) in existing commercial buildings.**
Available Situation/Purpose	Looking at the electricity subscriber numbers in Bursa province, it is seen that there are more than 210,000 commercial subscribers in the city. An examination of the 2014 data shows that approximately 9% of total energy consumption originates from commercial and public buildings.

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	Commercial buildings have higher energy consumption and energy prices than residential buildings, therefore, at least 25% of them will incorporate thermal insulation measures by 2030 as insulation and other energy efficiency practices will be more cost-effective. And energy consumption is expected to decrease by at least 20%.
Activities /Steps	- Raising awareness among commercial building owners on the subject. - Providing assistance in finding easy financing options. - Demonstrating financial return through simple feasibility studies.
Timing	2016-2030
Cost	Because commercial building sizes can vary so much, estimating them is quite difficult.
Saving Quantity	**298,621 MWh** energy savings, **119,704 tCO2e** reduction .
Investor	Commercial building owners
Stakeholders	Building owners, installation companies, material manufacturers, IZODER, ENVERDER,
BBB Contribution	Guide and coordinator
Risks	Commercial property owners, especially those who rent out their properties, may be reluctant to invest as they are not interested in reducing consumption.

Action B3.2	**Energy-efficient lighting in existing commercial buildings.**
Available Situation/Purpose	Electricity consumption in commercial buildings is around 4% of the total consumption of the city. This A significant portion of energy consumption also comes from lighting. The relatively high cost of energy and high consumption make investments in this area cost-effective. Previous similar studies have shown that conversion to energy-efficient lighting systems pays for itself in less than a year. It is predicted that a 10% energy saving can be achieved in 50% of commercial buildings.
Activities /Steps	It is predicted that the issue will likely result in higher conversion rates due to pressure from the central government and the relevant ministries.
Timing	2016 - 2030
Cost	Since the number of lights is unknown, it is difficult to determine a total cost.
Saving Quantity	A reduction of **174,014 MWh** in electricity consumption and **86,067 tons of CO2e** emissions. It is anticipated.
Investor	Commercial enterprises
Stakeholders	Energy-efficient lighting manufacturers, recycling facilities.
BBB Contribution	Informative, guiding
Risks	There are no commercial or technical risks.

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Objective B.4: *Reducing energy consumption in public buildings, primarily municipalities, in Bursa province through energy efficiency practices.*

Objective: *To prevent heat loss in winter and heat gain in summer in public buildings, reduce fuel consumption, lower greenhouse gas emissions, and raise public awareness through best practices.*

Stakeholders: *BBB (Istanbul Metropolitan Municipality), district municipalities, insulation material manufacturers, electro-mechanical application companies, ETKB, financial institutions, professional organizations, IZODER, various funding sources, development agencies, ENVERDER*

Objective B4: Energy-efficient practices in municipal buildings.
Action B4.1: Energy-efficient renovations of existing municipal buildings

Eylem B4.1	**Energy-efficient renovations in existing municipal buildings.**
Available Situation/Purpose	The number of municipalities in Bursa province, including district municipalities and affiliated companies, has a very high number of subscribers. Although the total share of these units in energy consumption is quite low, it is important for them to set an example in raising public awareness and fostering energy efficiency consciousness. The "Energy Efficiency Strategy Document" prepared by the Ministry of Energy and Natural Resources (ETKB) in 2012 includes the clause: "Energy audits will be conducted in the buildings and facilities of public institutions, and efficiency-enhancing projects will be prepared; budget allocations for maintenance and repair will be used primarily for these projects." ETKB has begun work on this issue and has conducted energy audits in many public buildings, primarily its own. Implementing insulation in municipal buildings can reduce natural gas consumption, which amounted to 26.8 million m3 in 2014. This will also lead to a decrease in lighting costs, which constitute a significant portion of electricity consumption.
Activities /Steps	20% saving in total electricity consumption. The goal is to achieve a 40% energy saving by implementing energy efficiency practices (thermal insulation, use of thermostatic valves, energy management systems, etc.) in 50% of municipal buildings.
Timing	2016 - 2030
Cost	
Saving Quantity	A total of **35,215** energy reductions are planned for lighting in all municipal buildings. The target is to reduce **MWh** of electricity and **17,417 tons of CO2e** emissions. With thermal insulation applications, a saving **of 46,218 MWh** of natural gas and electricity (cooling) and a reduction of **19,729 tCO2e** emissions are achieved, resulting in a total saving **of 81,433 MWh** and **a reduction of 37,146 tCO2e.** The aim is to reduce it.
Investor	Metropolitan Municipality

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Stakeholders	Lighting companies, financial institutions, installation firms
BBB Contribution	Investor
Risks	High initial costs, shortage of human resources in the Municipality.

Objective B5: Energy-efficient street lighting systems
Action B5.1: Energy-efficient street lighting system
Action B5.2: PV integration into street lighting systems

Objective B.5: *To reduce energy consumption in Bursa province through energy efficiency applications in street lighting and public buildings, primarily the municipality.*

Objective: *To achieve energy savings through energy-efficient street lighting.*

Stakeholders: *BBB (Istanbul Metropolitan Municipality), district municipalities, energy-efficient lighting manufacturers, financial institutions, Ministry of Energy and Natural Resources, various funds, development agencies.*

Action B5.1	**Energy-efficient street lighting system**
Available Situation/Purpose	As of the end of 2014, there were a total of 6,907 lighting subscribers in Bursa province. While precise information on the number of fixtures and lamps is unavailable, this represents approximately 0.3% of the city's total electricity consumption. The municipality plans to replace street lighting (in parks and gardens) with LED lighting. LED lighting applications have already begun to appear in various parts of the city. LED lighting is known to last much longer than other types of lighting. By replacing the lighting with energy-efficient ones; • Reducing energy losses and inefficiencies • Reducing energy, repair and maintenance costs • Energy and natural resource conservation • Waste reduction is the goal. Announcing the change through energy-efficient systems is important, as it is also a crucial part of visibility and awareness campaigns. (Overpass in Bursa using LED lighting)
Activities/Name Imlar	It is projected that all lighting in the city will be replaced with LED lighting by 2030. Replacing all streetlights with LED lighting will result in an 80% saving.

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Timing	2016 – 2030
Cost	It is known that there are 6,907 lighting subscribers, but since the exact number of lighting poles is unknown, no cost estimate has been made.
Saving Quantity	Replacing all lighting systems in the city with LED lighting is expected to result in an energy saving **of 172,920 MWh** and a reduction in CO2 emissions **of 85,526 tCO2e .**
Investor	BBB, Other public institutions, district municipalities
Stakeholders	Ministry of Energy and Natural Resources, financial institutions, producers
Risks	The municipality lacks financial resources and staff capable of conducting feasibility studies. lack of resources

Action B5.2	**PV integration into street lighting systems**
Available Situation/Purpose	By integrating photovoltaic power systems into street lighting installed with energy-efficient lighting systems, it is possible to reduce consumption, which is already reduced by 80%, to zero. Solar energy integration can be achieved in 20% of street lighting systems that have switched to LED lighting.
Activities /Steps	Energy consumption was reduced by applying PV technology to 20% of the poles, which were entirely replaced with LED lighting.
Timing	2016 – 2030
Cost	The exact number of poles where the lighting system will be replaced cannot be calculated because it is unknown.
Saving Quantity	**11,067 MWh** of energy saved . . The target is a reduction in emissions **of 5,474 tCO2e .**
Investor	Metropolitan Municipality, district municipalities
Stakeholders	Financial institutions, funds, lighting manufacturers,
BBB Contribution	Investor, guide
Risks	Cost factor

OTHER MITIGATING MEASURES DISCUSSED AT THE WORKSHOP

The following mitigation measures were proposed by the relevant working group at the workshop on September 10, 2015, but could not be quantified.

- Municipalities should develop incentive mechanisms for building owners who save energy.
- Reducing pressure on Nilüfer district by creating new attractions
- New construction areas should not be selected from agricultural, forest and green areas, green areas should be preserved increase.
- Increasing inter-institutional cooperation

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Transportation is considered one of the main components of quality of life. European Union policies and programs address the relationship between quality of life and transportation, particularly from the perspectives of sustainability and social integration. The sustainability of natural and energy resources and the prevention of environmental pollution are key determinants in the development of transportation policies.

On the other hand, it is stated that ensuring the efficiency of transportation in daily life is important for improving quality of life and the happiness of individuals. Providing adequate and economically affordable transportation infrastructure is primarily important for regular daily commutes between home and work. Ensuring efficient transportation infrastructure for commuting is effective in both increasing employee productivity and establishing a work-life balance. Transportation is also important for another type of regular daily commute: commuting between school and home.

Providing adequate and affordable transportation infrastructure for journeys between school and home is crucial, both for the productivity and development of young people and for the economic well-being of their families.

TABLES 4-5: TRANSPORTATION INDICATORS

	Türkiye	TR41	Bursa
Cars per thousand people number	114	123	117
Length of provincial and state roads per thousand km² (km)	81,77	85,07	106,99
Railway length per thousand km2	12,53	20,02	1,54

Source: Turkish Statistical Institute (TUÿK), 2013

Of the 915 logistics transportation companies registered with the International Transporters Association (UND) across Turkey, 15 are located in Bursa. The logistics sector is not well-organized within the province. Logistics companies have scattered across residential areas, mostly near customs and industrial zones.

These areas are located at the city's entry and exit points and the port area. The fact that logistics companies are not organized and clustered in specific centers between the ports, organized industrial zones, and free zones negatively affects urban traffic.

In Bursa province, importance is given to logistics training. The Bursa Chamber of Commerce and Industry and the Uludaÿ Exporters Association provide training, seminars, and meetings related to the logistics sector.

One of the most important transportation modes for Bursa is RO-RO (Roll-on/Roll-off). Used primarily in trade with European Union countries, RO-RO transportation allows for integrated transport using both road and rail. Many ports with significant RO-RO capacity are located near Bursa. The North Aegean Port, planned for completion in the near future, will greatly benefit Bursa in terms of RO-RO and other transportation modes. Furthermore, considering the development of connections with points within the Marmara Sea such as Tekirdaÿ Akport and Gemlik, Bandÿrma, and Derince, a significant increase in capacity for Bursa can be expected.

The primary reason for the increase in greenhouse gas emissions in urban transportation is the rise in private vehicle ownership, i.e., car ownership, and consequently, the increase in car-based travel within cities. City dwellers are increasingly preferring to use motorized vehicles, including cars, over walking.

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The shift towards using cars leads to an increase in energy consumption and emissions per passenger carried in urban transportation. Cars create 125 times more air pollution per passenger per kilometer than buses, and when considering energy consumption per passenger/kilometer, they consume five times more energy than buses and subways.

In Bursa, pedestrian and public transport use has a high rate. However, if urban development becomes widespread and fragmented, and if car-centric transportation policies are supported, the share of these modes of transport in urban transportation will decrease. While private vehicle use is rapidly increasing, making new road investments to further support this development has disadvantages in terms of both the increase in private vehicle use and its impact on energy consumption.

Furthermore, the increasing use of automobiles for urban transportation, the continuous expansion of land allocated to roads in cities, the transformation of natural surfaces into asphalt, and the widening of roads are leading to the deterioration, and in some cases the complete elimination, of pedestrian accessibility.
Cars carry three times fewer passengers than minibuses and 13 times fewer passengers than buses; transporting the same number of passengers by car instead of public transport means using more road space. For example, to transport 40,000 people across a bridge by bicycle in an hour, one lane would be needed, and so would the train lane.
While two lanes are needed to allow passage by road and four lanes to allow passage by buses;
Twelve lanes are needed to accommodate cars. Eighteen bicycles can be parked in the space occupied by one car; 30 bicycles can move in the space occupied by a single car. Compared to other modes of transportation, it is clear that cars are an inefficient option in terms of emissions and air pollution per passenger, energy consumption, and space utilization.

Furthermore, the continuous increase in car usage and, consequently, traffic levels leads to insufficient road capacity, resulting in traffic congestion, and in congested conditions, greenhouse gas emissions from vehicles increase even further. In the past, cities that tried to increase road capacity by widening roads in response to this problem have seen that this approach has actually encouraged and increased car usage even more.

Globally, despite the increase in car ownership and use, it has become clear that creating a car-dependent urban transportation system is an unsustainable approach, that public transportation and "non-motorized" modes of transport such as cycling and pedestrian travel should be developed and supported, and that limiting car use in the central areas of cities is inevitable.

Another development trend that increases greenhouse gas emissions in urban transportation is the spatial growth of cities, the scattered location of urban uses, the development of low-density housing areas on the outskirts of cities, and as a result of all these trends, the increase in the average length of journeys per person. The main factor triggering this spatial growth and scattered development in cities is actually the increase in car use. On the other hand, as the distances over which cities spread increase and urban uses become more spatially dispersed, it becomes impossible to effectively serve all of them with public transportation; walking and cycling over long distances also cease to be viable options; this situation further supports and increases car use. This vicious cycle creates cities and lifestyles dependent on cars, leading to further growth and sprawl of cities. Meanwhile, as a result of the widespread growth of cities, the transformation of natural areas surrounding cities into built environments, the conversion of natural ground to asphalt, increases radiation levels, negatively affecting both local air quality and microclimate in cities, and increasing global warming.

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In Bursa, the negative developments identified in the urban development phase exacerbate the city's vital functions and, most importantly, its transportation problems. The transportation infrastructure and management, which have not developed in accordance with the increasing population and expanding urban area, make life difficult for the city, disrupt urban functions, and move the city away from a sustainable transportation system. Transportation emissions, which constitute a significant part of Bursa's greenhouse gas emissions inventory, can be reduced not only by addressing existing acute problems but also by implementing a long-term Urban Transportation Strategy. **The "Bursa Transportation Master Plan,"** completed by the Metropolitan Municipality in 2012 , is a transportation strategy prepared with this goal in mind, aiming to plan long-term urban development.

The Transportation Plan can be based on the premise that Bursa currently has a per capita mobility value of 1.43 on normal weekdays, which is far behind the values of Western European cities and even Istanbul (1.74 trips per person per day), and that there is significant potential for increasing this mobility value on weekdays.

Past records (1.00 trips/person for 1986 and 1.12 trips/person for 1990) also document an increasing trend. A logarithmic increase in mobility is expected, driven by factors such as vehicle ownership and population growth. Therefore, the average number of trips...

It is estimated that there will be a 5% increase by 2020, reaching a value of 1.50, and a 10% increase by 2030, reaching a value of 1.57. In 2010, these values were partially reached in individual regions (Osmangazi, Nilüfer).

TABLES 4-6: PUBLIC TRANSPORTATION SYSTEM TRAVEL VALUES

		2010		2030	
Number of Passengers	HRS	14718	% 18,30	26870	% 25,49
	Bus	39488	% 49,10	47377	% 44,95
	Microbus	18389	% 22,86	21851	% 20,73
	shared taxi	7833	% 9,74	9301	% 8,82
	Total	**80428**	**% 100**	**105399**	**% 100**
Passenger – km	HRS	60518	% 14,53	119090	% 21,86
	Bus	259571	% 62,32	359391	% 65,97
	Microbus	51668	% 12,40	58147	% 10,67
	shared taxi	7775	% 1,87	8078	% 1,48
	Total	**416532**	**% 100**	**544756**	**% 100**

Source: Bursa Main Transportation Plan

The Bursa Main Transportation Plan presents the current and potential transportation distributions for 2030 in the city according to different modalities as follows:

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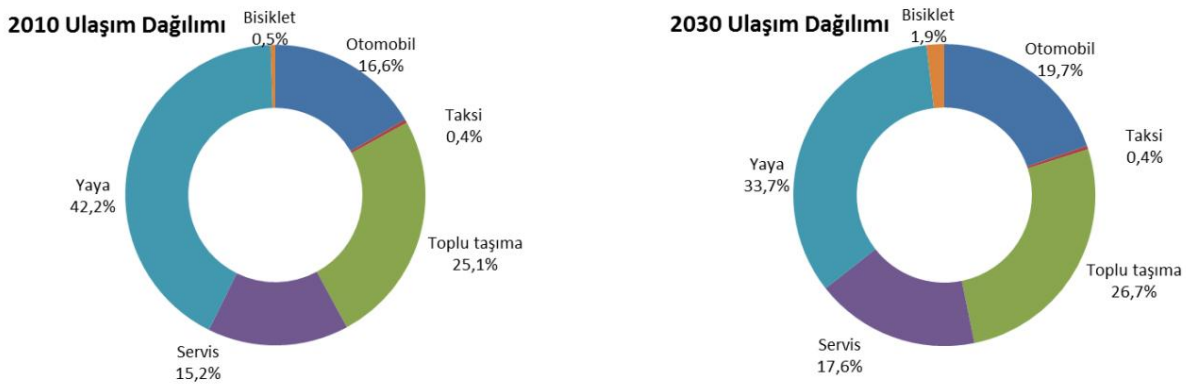

FIGURE 4-1: DISTRIBUTION OF TRANSPORTATION MODES IN BURSA BETWEEN 2010 AND 2030

The analyses conducted while preparing the Transportation Master Plan provide important data and results regarding measures to reduce energy intensity in transportation. The survey studies show the distribution of daily journeys in Bursa as shown in the graph above.

One of the striking points in the distribution shown in the graph is the share of pedestrian transportation. Nearly half of these journeys are made to get to work, and about one-third are made to get to school.

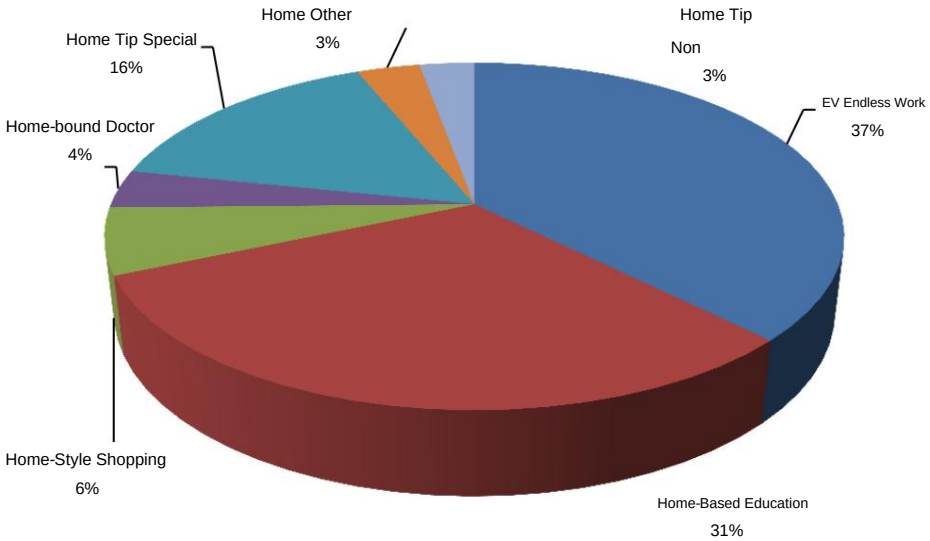

FIGURE 4-2: DISTRIBUTION OF REASONS FOR DAILY TRANSPORTATION IN BURSA (BUAP, 2012)

In Bursa, the rail system, consisting of four tram lines and eight primary bus lines, forms the backbone of public transportation. These modes of transport fulfill their function and are used on the axes where demand is highest. Other systems (secondary bus lines and microbus transportation with vehicles somewhere between minibuses and buses) are adjusted accordingly and used based on demand and regional conditions (road width, topography).

Another element included in the Plan is the merging of shared taxi and minibus transportation systems to form microbus lines, and assigning these lines the task of feeding primary and secondary network lines.

The medium-term proposals of the Transportation Master Plan are listed below:

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- A complete restructuring of the public transport network is necessary, with a hierarchical structure. This is essential for permanently strengthening public transport. At the same time, a number of conditions must be met to implement this fundamental restructuring. These include improving and developing the light metro system to achieve a 2.5-minute service interval in the central route section, and ensuring sufficient capacity for light metro and tram systems.

- Establishing an appropriate public transportation system during the expansion of settlements This is necessary. For this reason, the planned 2030 target concept for public transportation should be fully implemented by 2020.
- The light rail system should be extended westward and eastward from Kestel to reach these areas along with the existing settlements. Given the anticipated high population load in the regions through which the rail system routes pass due to settlement expansion, the rail system should be extended to these areas ahead of schedule to ensure public transport connectivity for the residents.

- Expanding the bus and minibus network in new residential areas also increases the number of residents. This should be done before the project begins. Once settlement is established, operations could start with shorter service intervals or using smaller vehicles. Service should then be improved based on demand. Similarly, bike-and-ride and park-and-ride capacities should also be expanded.

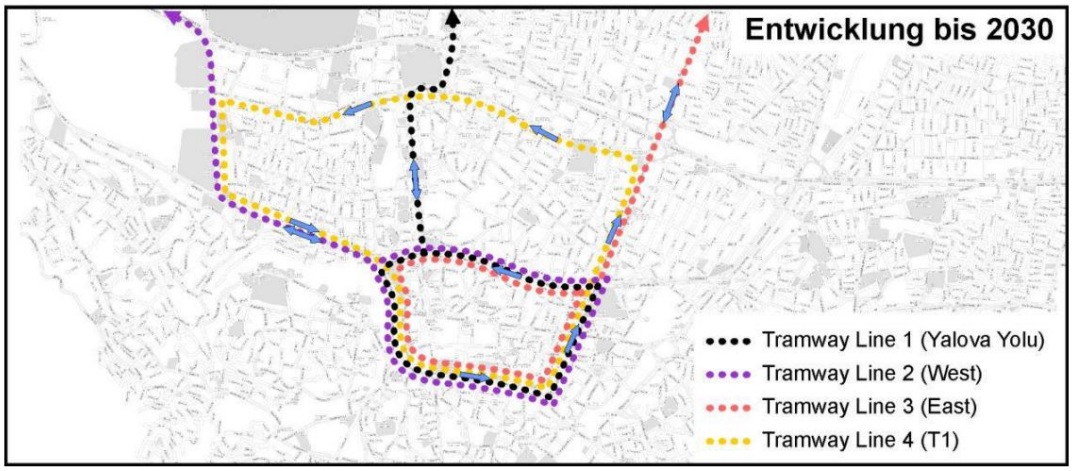

FIGURE 4-4: DEVELOPMENT OF THE TRAMWAY NETWORK IN OSMANFAZI CITY CENTER BY 2030

Source: Bursa Transportation Master Plan

The long-term proposals of the Transportation Master Plan are listed below:

Continuous monitoring of demand should be carried out across the entire network. Electronic ticketing statistics can also be evaluated for this purpose. To meet passenger demand and achieve high economic efficiency, regular adjustments to travel services are necessary. These adjustments should be implemented annually, but at most every six months, at a fixed time for the entire travel service. When there is a very good line load, the first step should be to use larger vehicles, and then the service interval on that line should be controlled. If meeting demand by increasing the service interval is not possible, for example in light rail or tram systems, then the load on route sections should be alleviated by adding new lines. In general, a similar approach should be taken across the entire network.

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Efforts should be made to structure different services accordingly. The lowest level of public transport should always be available during periods of low load and in areas with low demand.

Here, particular attention should be paid to suitable transfer options.

TRANSPORTATION REDUCTION MEASURES

Objective U1: The aim is to reduce the use of motorized vehicles in traffic by expanding the use of public transportation.

Target: *A 7.5% reduction in transportation emissions.*

Stakeholders: BBB, Burulaÿ, Provincial Directorate of Traffic, Ministry of Transport, financial institutions,

Objective U1: To promote the widespread use of public transportation.
Action U1.1: Increasing the rate of public transport use.
Action U1.2: Ensuring the connection of Bursa with the highway and high-speed rail network.

Action U1.1	Increasing the rate of public transportation use.
Available Situation/Purpose	While the use of rail systems is becoming increasingly widespread in Bursa province, the long waiting times at stations, the lack of integration with other public transportation options in some areas, and the relatively high cost are leading to a growing trend of private vehicle use. Until recently, shuttle buses used by public institutions were phased out to encourage the use of public transportation, but this unfortunately seems to have increased the use of private vehicles (the number of vehicles in institutional parking lots is increasing day by day). The use of public transportation should be increased through various measures. Although the 2030 Transportation Master Plan aims to increase the share of public transportation from 25.1% to 26.7%, it is predicted that this can be increased to 30% with the necessary measures. This will reduce the use of private vehicles. Removing one vehicle from traffic results in a reduction of approximately 2 tons of CO2e emissions per year.
Activities/ Steps	• Reducing passenger waiting times at bus stops • Route optimization in rubber-wheeled public transport vehicles • Increasing the frequency of Bursaray services • Development of the rail system network • Increasing the number of feeder lines to the rail system; Integrated ticketing system. making public transportation more economical by optimizing it • Increasing the number of public transport transfer stations and improving their infrastructure With measures such as these, a 7.5% energy saving is targeted.
Timing	2016-2030

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Cost	Additional train cars should be purchased to shorten passenger waiting times. Other actions are relatively less costly.
Saving Quantity	The goal is to achieve an energy saving **of 619,014 MWh** and a reduction in CO2 emissions **of 161,405 tCO2e .**
Investor	BURULAÿ
Stakeholders	BBB, various funds, Iller Bankasÿ, public transport vehicle manufacturers, Provincial Traffic Directorate, Ministry of Transport
BBB Contribution	BBB could collaborate with BURULAÿ, a subsidiary of BBB. They could optimize various road, intersection, and traffic signal arrangements.
Risks	The inability to change passenger behavior patterns necessitates the municipality to generate resources for relevant investments.

Action U1.2	**Ensuring Bursa's connection via highway and high-speed rail network.**
Available Situation/Purpose	Despite being close to major cities like Istanbul and Ankara, and being an important industrial city, Bursa lacks a railway network connection. The 105-kilometer project connecting Bilecik to the Ankara-Istanbul line, specifically the 75-kilometer section between Bursa and Yeniÿehir, is expected to have its infrastructure completed by the end of 2015 at a cost of 393 million Turkish Lira. The implementation projects for the 30-kilometer Yeniÿehir-Vezirhan-Bilecik section have been completed, and the tender was held at the beginning of 2012. Connecting Bursa to planned public transportation lines and major cities will provide many benefits. From the perspective of the Bursa Transportation Economy and Development Project (BÿDEP), these benefits, in terms of both reducing energy intensity in transportation and reducing emissions from transportation, can be summarized as follows: 1. With the rapid implementation of intercity rail options for passenger transport in modern facilities, it is foreseeable that a significant portion of these journeys will shift to high-speed trains. This will reduce the number of buses departing from Bursa bus terminal. 2. Rail transport offers significant cost and speed advantages over road transport in freight transportation. A substantial portion of agricultural production originating from Bursa will benefit from this option. 3. From a tourism perspective, the high-speed rail option is also beneficial for this sector. It can be said that it will lift a significant load.
Activities /Steps	• Development of the rail system network • Increasing the number of feeder lines to the rail system
Timing	2020-2030 (in stages)
Cost	
Saving Quantity	The high-speed rail connection will provide a 10% saving on transportation costs.

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	86,879 MWh of energy saved. . The target is a reduction of **35,171 tCO2e** in emissions.
Investor	Ministry of Transport investment
Stakeholders	BBB, international funding organizations, Iller Bankasÿ, wagon manufacturers, Ministry of Transport The ministry, the contracting firms that will work on rail and road construction.
BBB Contribution	Public transport should be directed to the high-speed train connection point.
Risks	Need for financial resources, difficulty in changing passenger habits.

Objective U2: *To promote cycling and pedestrian transportation within the city.*

Objective: The *goal is to reduce the use of motorized vehicles such as private cars and taxis by increasing bicycle use, raising the current bicycle usage rate of 0.5% to 2.5%, and increasing pedestrian transportation from 42% to 47%.*

Stakeholders: *BBB (Istanbul Metropolitan Municipality), Highways Directorate, citizens, large building management companies, universities, schools*

Objective U2: Increasing pedestrian and bicycle use and integrating them into public transport.
Action U2.1 Increasing bicycle usage rate from <0.5% to 2.5%
Action U2.2 Increasing pedestrian access from 42% to 47%

Action U2.1	**Increasing bicycle usage rate from 0.5% to 2.5%**
Available Situation/Purpose	Increasing bicycle use is primarily an infrastructure issue. As the European experience shows, allocating dedicated cycle paths, which are extremely low-cost, and ensuring safety is fundamentally a matter of planning. Bicycle transportation is used at a very low rate in Bursa today compared to other modes of transportation. Only 0.5% of journeys are made by bicycle. This is being implemented. Therefore, approximately 5% of households own one or more bicycles. Furthermore, considering the usage patterns (residence, work, school, shopping, leisure, etc.) and the urban layout of the region, it is necessary to create suitable areas for bicycle transportation in all parts of the topographically flat areas. Some streets (such as Sanayi Cd, Fatih Sultan Mehmet Blv., etc.) have bicycle lanes. However, these lanes are sometimes used as parking areas and are unsuitable for use due to structural and design flaws. - City center areas, - Densely populated areas, - Important stops (especially rail system stops).

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Activities /Steps	The Transportation Master Plan also lists the following measures to increase bicycle use: **Short and medium-term measures;** - Improving access to rail system stations, - Within the city, a bicycle transportation network exists between Uludaÿ University and Görükle. structuring, **Long-term measures:** - The study on bicycle transportation should be completed with a bicycle lending system. - Structuring bicycle transportation networks in new residential areas located in outer regions, - Completion of road signs and markers. The goal is to reduce energy consumption in all urban transportation by 2%.
Timing	2016-2030
Cost	Cost per kilometer of bike path
Saving Quantity	The goal is to reduce energy consumption **by 130,319 MWh** and emissions **by 33,980 tCO2e .**
Investor	Bursa Metropolitan Municipality, District Municipalities
Stakeholders	Various funds, the Provincial Bank, citizens
BBB Contribution	Investor, incentive
Risks	Need for financial resources, difficulty in changing passenger habits.

Action U2.2	**Increasing pedestrian use from 42% to 47%**
Available Situation/Purpose	In Bursa Metropolitan Municipality, pedestrian transportation accounts for 42.2% of all journeys made by the population, which is a significant figure. Pedestrian journeys are particularly high in the city center, in district centers with high shopping activity, in areas with high individual traffic (e.g., schools, sports facilities), and where there are important public transportation connections. The Transportation Master Plan lists the following measures that can be taken to increase pedestrian transportation. **Short-term measures** - Crossing the road in places where there is a high need to cross. improving opportunities - Ensuring barrier-free access to public transport stops. **Long-term measures** - Expanding pedestrian areas in city centers and district centers. - Completion of the installation of directional signage and traffic signs.
Activities /Steps	- Widening of pedestrian walkways - Creating areas closed to traffic

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	Healthy lifestyle trainings
Timing	2016 - 2020
Cost	The estimated cost is approximately 2.4 million TL.
Saving Quantity	By increasing pedestrian access from 42% to 47%, the goal is to achieve a 5% energy saving, resulting in a reduction of **325,797 MWh** of energy and **84,950 tons of CO2e** emissions.
Investor	Bursa Metropolitan Municipality, District Municipalities
Stakeholders	Provincial Health Directorate, various funds, Provincial Bank, citizens
BBB Contribution	Local governments are responsible for making urban roads pedestrian-friendly, including closing certain routes to vehicular traffic to create safe and attractive areas for pedestrians and cyclists.
Risks	Changing the habits of urban citizens

Objective U3: *Encouraging the use of alternative technologies and fuels in urban vehicles.*

Objective: *To achieve fuel and energy savings through the use of energy-efficient technologies.*

Stakeholders: *BBB, Ministry of Transport, BURULAÿ, citizens*

Goal U3: Alternative technology/fuel use and Intelligent Traffic Management
Action U3.1 Replacing public transport vehicles with energy-efficient vehicles (CNG, electric)
Action U3.2 Encouraging the use of electric vehicles and expanding incentive programs (e.g., establishing solar charging stations)

Action U3.1	**Replacing public transport vehicles with energy-efficient vehicles**
Available Situation/Purpose	Public transportation is estimated to account for over 1% of the city's energy consumption. While the municipality's bus fleet is being modernized, the average age of the vehicles is around 7-8 years. The measures foreseen in the Transportation Master Plan regarding this issue are as follows: Necessary precautions: - Operating with modern and high-capacity buses. - Although not included in the Transportation Master Plan, it should be noted that the use of alternative fuels should also be considered, taking into account the positive contributions of the following steps of the BÿDEP (Broadening Energy and Development Project).
Activities /Steps	- BURULAÿ owns 325 buses (as of 2014). Replacing older vehicles with newer, more fuel-efficient ones is an important step to be taken in this regard. - Replacing some of the vehicles with CNG vehicles during the renovation process. - Gradual replacement of vehicles with electric and biofuel-powered vehicles.

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Timing	2016 - 2030
Cost	A single CNG refueling station costs €200,000-€250,000, and vehicle conversion costs €2,500 per vehicle. Prices are expected to fall further within a few years as the technology becomes more widespread and affordable. The cost of an electric charging station is approximately 40,000 TL (negotiations with manufacturers).
Saving Quantity	Replacing all public transportation vehicles aims for an 80% energy saving. This targets **a 304,125 MWh** energy saving and a reduction of **82,606 tCO2e** in emissions.
Investor	BURULAÿ, Private Public Bus Owners
Stakeholders	Funding sources: Provincial Bank, citizens.
BBB Contribution	Investor institution
Risks	High initial investment costs.

Action U3.2	**Encouraging the adoption of electric vehicles and expanding incentive programs (such as establishing solar charging stations)**
Available Situation/Purpose	Since electricity production in our country is still based on fossil fuels and inefficient facilities, while encouraging the use of electric vehicles, special attention should be paid to supporting this with solar energy. There is a significant effort to develop electric vehicle technologies, especially storage systems and batteries, and almost every vehicle manufacturer seems to be preparing for this development. Because this issue is closely linked to national policies, some applications have been included in BÿDEP (Electric Vehicle Development Program) primarily as demonstrations and examples.
Activities/Name Imlar	• Replacing 80% of the municipal vehicle fleet with electric/hybrid vehicles by 2030. In addition to purchasing electric vehicles, leasing options should also be considered. • Encouraging other vehicle owners to use electric vehicles
Timing	2016-2030
Cost	The cost of an electric vehicle fast charging station is approximately 40,000 TL, and a 50 kWp photovoltaic power panel requires an investment of 175,500 TL (negotiations with private companies).
Saving Quantity	**Replacing** 80% of the municipal vehicle fleet with electric and hybrid vehicles will result in energy savings of 22,451 MWh and a reduction **of 6,093 tCO2e .**
Investor	BBB, Municipality subsidiaries
Stakeholders	Various funds, the Provincial Bank, vehicle manufacturers, and vehicle maintenance companies.

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BBB Contribution	Infrastructure investments, preferential road and parking applications.
Risks	The fact that sample applications are still very limited, and the costs...

Objective U4: *To reduce traffic congestion and energy consumption through low-investment traffic optimization regulations.*

Objective: *To reduce energy consumption caused by traffic congestion.*

Stakeholders: *BBB, BURULAÿ, citizens*

Goal U4: Alternative technology/fuel use and Intelligent Traffic Management
Action U4.1 Low-investment traffic optimization arrangements

Action U4.1	**Low-investment traffic optimization regulations**
Available Situation/Purpose	Reviewing the public transportation routes and lines that municipalities currently implement and revise according to traffic density and changes, as well as optimizing traffic flow control, speed, and signaling, prevents traffic congestion and saves energy consumption. Studies show that such measures can prevent carbon emissions by up to 20%.
Activities/Name Imlar	• Establishment of a traffic management center within the municipality (regarding this matter) (Studies are ongoing) • Improvement of the passenger/driver information system • Development of a signaling system
Timing	2016 – 2030 (Signaling adjustments should be made regularly depending on newly constructed roads and changes in traffic density.)
Cost	
Saving Quantity	These measures are expected to reduce total emissions from transportation by 10%. This translates to a reduction of **558,930 MWh of energy and 203,880 tCO2e** of emissions . is the goal.
Investor	Metropolitan Municipality Transportation Department, Police Department, Traffic Directorate
Stakeholders	Citizens,
BBB Contribution	Implementing institution
Risks	Financial and human resource needs

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Goal U5: *Reducing emissions from logistics and transportation fleets.*

Objective: *To reduce energy demand stemming from the logistics and transportation sectors in this industrially dense city.*

Stakeholders: *All industrial and logistics organizations, BBB, BTSO*

Goal U5: Reducing emissions from logistics and transportation fleets.
Action U5.1: Reducing emissions from logistics and transportation fleets.

Action U5.1	Reducing emissions from logistics and transportation fleets.
Available Situation/Purpose	Bursa is an important industrial city with highly developed automotive, textile, and food industries. Its proximity to Türkiye's largest markets and its exports increase the added value created, but they also have negative effects on the city's traffic. It is estimated that transportation emissions from logistics account for 48% of all urban transportation emissions. (This percentage was reached by estimating the annual fuel consumption of the number of trucks and vans in the city.)
Activities/Name Imlar	The establishment of a Bursa Logistics Center is among BTSO's strategic plans. The center is expected to reduce the need for intra-city logistics. In the EU, urban deliveries have begun to be carried out using electric vehicle fleets under the title "last mile delivery". A similar development is expected in Türkiye as well.
Timing	2016 - 2030
Cost	
Saving Quantity	The goal is to reduce emissions from logistics by 15%. This targets a reduction of **691,298 MWh, or 187,769 tCO2e .**
Investor	Industrial and commercial sectors, logistics companies.
Stakeholders	BBB, industrial and commercial sectors
BBB Contribution	As a regulator, guide, and enforcer
Risks	costs are not falling fast enough

Action U6.1 Education and Awareness

Action U6.1	Education and Awareness
Available Situation/Purpose	Providing training on economical driving techniques to drivers of public transportation vehicles, taxis, and subsequently all commercial and private vehicle owners, will enable drivers in urban traffic to reduce fuel consumption. Various studies show that economical driving training leads to reductions in vehicle fuel consumption of up to 10%.
Activities	These trainings can be expanded through municipal training centers. District

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/Steps	Support can be obtained from municipalities, industrial organizations, and especially logistics companies.
Timing	2016 - 2030
Cost	The cost of economical driving techniques training across Türkiye is approximately 200. The price is TL per person.
Saving Quantity	The goal is to reduce emissions from logistics by 5%. **230,433** The target is a reduction in emissions **of 62,590 tCO2e per MWh** of energy .
Investor	Industrial companies, logistics firms, drivers using private public transport, BBB, Burulaÿ, district municipalities
Stakeholders	Various agreements and collaborations can be made with educational institutions.
BBB Contribution	Investor and guide
Risks	Social acceptance, inability to dedicate time to training.

OTHER MITIGATING MEASURES DISCUSSED AT THE WORKSHOP

- Development of the city's parking infrastructure and its integration with the public transportation system.
- Increasing the use of rail transport in logistics transportation
- Development of passenger and driver information systems

4.1.3 RENEWABLE ENERGY

While increasing energy efficiency and expanding the use of renewable energy sources is a crucial need in the TR41 region, its renewable energy potential is not being effectively utilized. Although the region has moderate solar and wind energy potential, and biofuel energy potential in Bursa and Bilecik provinces, the most commonly used renewable energy type is hydroelectric capacity. Significant decreases in rainfall are among the effects of climate change that will be felt more severely from 2030 onwards. Therefore, there is a possibility that water-based energy production capacity will create a serious weakness. Furthermore, increasing energy efficiency and developing energy production systems that utilize the renewable energy potential in the region are also important.

Until now, city administrations' relationship with energy supply has been mostly passive, except for exceptional cases. Local government companies, which have begun to engage in practices such as natural gas distribution, have started to appear in the city energy landscape in the last 20 years with energy market deregulations.

The rapidly falling costs of renewable energy sources, and especially the increasing attractiveness of solar energy in high-radiation regions (the solar belt), combined with the protection that distributed energy supply systems provide against energy insecurity, power outages, geopolitical considerations, and energy price imbalances, have led to the picture we see in many countries today. Local governments have begun to take an active role in urban energy supply and even involve the public in energy production through various ownership structures. These developments, most notably seen in Germany and the Scandinavian countries, are gradually becoming more widespread.

It is foreseeable that it will begin to emerge in Türkiye as well.

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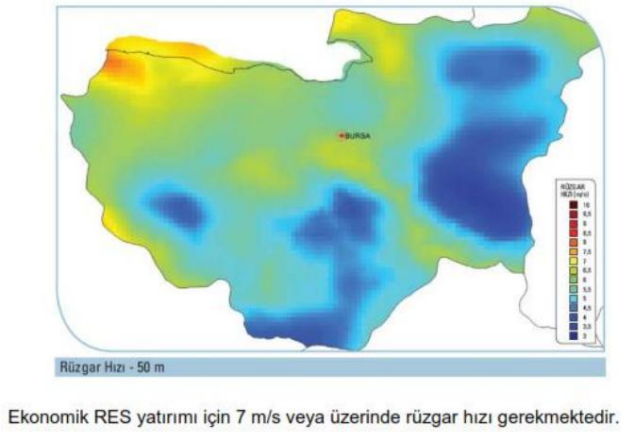
WIND ENERGY POTENTIAL OF BURSA PROVINCE

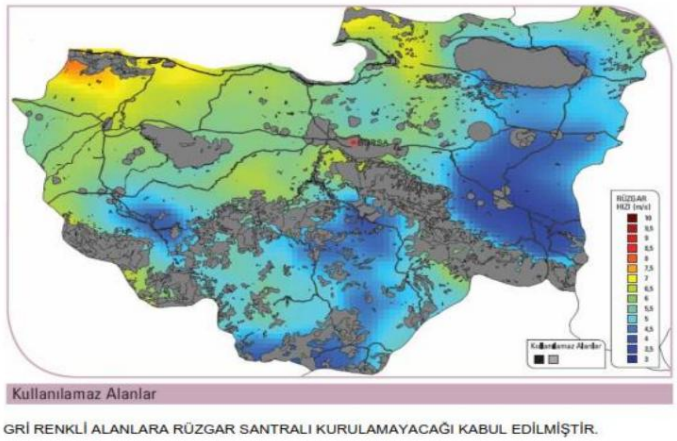
Bursa is located in the Marmara Region, which is the most fortunate region in Türkiye in terms of wind energy potential. However, Bursa does not have the same potential as other provinces in Southern Marmara such as Balÿkesir, Yalova, or Çanakkale. According to the Wind Energy Potential Atlas published by the General Directorate of Renewable Energy, the wind map of the province is given below.



FIGURES 4-5: WIND SPEED DISTRIBUTION IN BURSA PROVINCE - 50 METERS

Source: General Directorate of Renewable Energy

Due to Bursa's high population density and agricultural production areas, the limited regions where wind power plants can be established are also listed in the Wind Energy Potential Atlas (REPA).



FIGURES 4-6: AREAS SUITABLE FOR THE CONSTRUCTION OF WIND POWER PLANTS.

Source: General Directorate of Renewable Energy

According to the General Directorate of Renewable Energy's (YEGM) wind potential analyses, the wind energy power generation potential in Bursa is shown in the table below.

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TABLE 4-7: POTENTIAL WIND POWER PLANT POWER CAPACITY THAT CAN BE ESTABLISHED IN BURSA PROVINCE

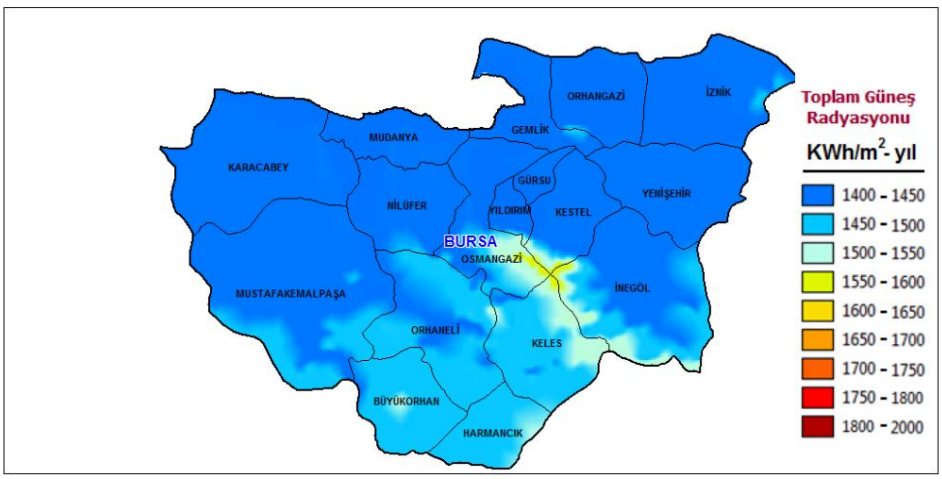
Wind power at 50 m (W/m2)	Wind speed at 50 m (m/s)	Total Area (km2)	Total Installed Power (MW)
300 – 400	6.8 – 7.5	683,60	3.418,00
400 – 500	7.5 – 8.1	85,22	426,08
500 – 600	8.1 – 8.6	5,23	26,16
600 – 800	8.6 – 9.5	2,29	11,44
>800	>9.5	0,00	0,00
		776,34	**3.881,68**

It is stated that out of a total installed power potential of approximately 3.8 GW listed throughout the province, only 400 MW has feasibility for investment (source: EMO, Bursa Renewable Energy File).

SOLAR ENERGY POTENTIAL OF BURSA PROVINCE

As stated in the announcement text published by the Ministry of Energy and Natural Resources regarding licensed solar power plants, a total capacity of 600 MW has been distributed among transformer capacities in different provinces.

Locations suitable for the construction of licensed solar power plants have been selected from areas with solar radiation exceeding 1650 kWh/m².year; Bursa is not included in these locations. The General Directorate of Renewable Energy's Solar Energy Potential Atlas for Bursa is given below.



FIGURES 4-7: GLOBAL SOLAR RADIATION DISTRIBUTION

Source: General Directorate of Renewable Energy

Similarly, YEGM has identified areas in Bursa where solar power plants can and cannot be built.

In the Bursa province map below, areas that are not usable have been left white.

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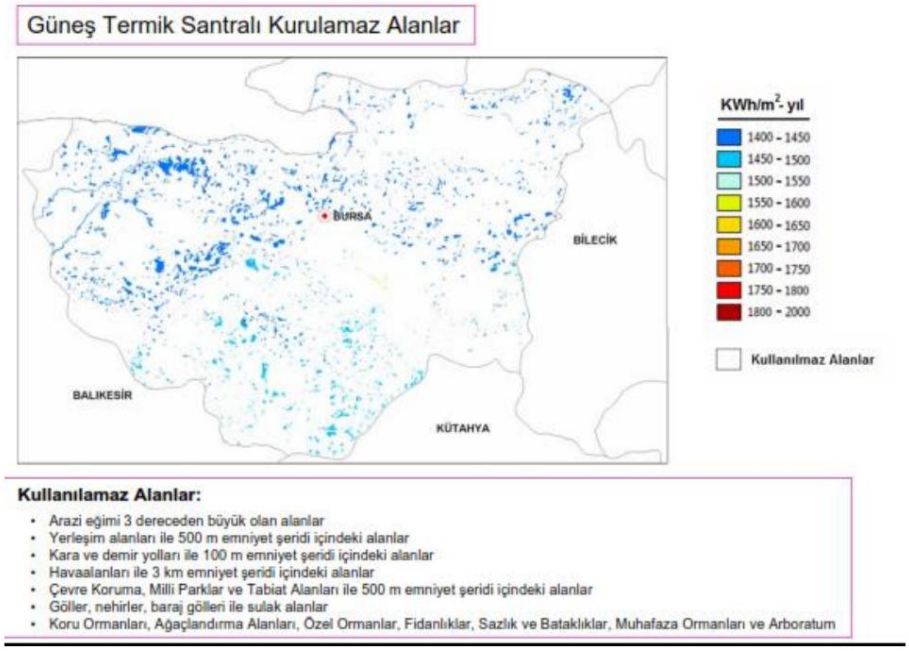

FIGURES 4-8: AREAS WHERE SOLAR ENERGY SYSTEMS CANNOT BE INSTALLED.

In areas with higher radiation intensity towards the south of the province, land limitations are greater due to agricultural areas, protected areas, and population densities. These assessments are undoubtedly made for the establishment of licensed wind and solar power plants.

Most of the small and medium-sized solar power plants that Germany has installed have an average solar radiation intensity of 900 kWh/m2.year . Considering the electricity capacity, averaging 1450 kWh/m2.year , it is assessed that unlicensed capacity installations, especially for self-consumption, could be attractive in Bursa province, both for agricultural irrigation and for commercial and industrial enterprises.

Indeed, analyses conducted for Organized Industrial Zones have revealed a significant roof area and solar production capacity.

GEOTHERMAL ENERGY POTENTIAL OF BURSA PROVINCE

Located in the Alpine-Himalayan belt, Turkey, along with Italy, Greece, Tibet, and the People's Republic of China, possesses a very high geothermal potential. Turkey ranks among the top seven countries in the world in terms of geothermal energy potential for heating purposes. Today, there are between 600 and 1200 hydromineral and thermomineral resources in the country. High-temperature geothermal resources are generally located in Western Anatolia, while low and medium-temperature resources are found in Central and Eastern Anatolia.

Bursa is one of the provinces rich in geothermal energy resources. In particular, the hot springs in Bursa are used for therapeutic purposes in spas and tourist facilities. While geologically dating back to very ancient times, the public use of thermal springs in Bursa dates back to the Byzantine Empire period.

The Byzantines, who founded a water city called "Piti" in the region known today as Çekirge, built a magnificent palace and a large bathhouse there during the reign of Justinian.

Initial research on geothermal energy generally focused on regions with hot springs. As part of these studies aimed at introducing new energy sources to our country, the MTA (Mineral Research and Exploration Institute) geophysics and resistivity team examined an area encompassing the hot springs of Bursa city in terms of geothermal energy potential. The aim of the study was to determine the condition of the reservoir rock containing the geothermal fluid and its tectonic structure by utilizing the variation of geoelectric parameters with temperature.

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The aim is to reveal the relationship between them. The study area includes the ridges and valleys extending to the plain on the northern slopes of Uludaÿ, the alluvial cones at the valley mouths, and densely populated areas in the northwestern part of Bursa city such as Çekirge, Muradiye, Hürriyet, and Çiriÿhane. According to the studies conducted, hot springs have been examined in the following groups:

1. Locust Group Hot Springs

The water from these springs is used in hotels, hospitals, and baths belonging to official and private institutions in the Çekirge region. Hot water from the Vakÿfbahçe spring is supplied to the Çelik Palas hotel through an insulated pipe more than 2 km long. A temperature loss of 4°C has been observed along this pipeline.

In addition, hot water obtained from boreholes drilled by private individuals in this region, reaching depths of up to 60 m, is used in baths and heating systems of buildings. The temperatures of the Çekirge group of hot springs are low, as shown in the Table below.11

TABLES 4-8: VALUES AND ECONOMIC CONTRIBUTION AMOUNT FOR LOCUST GROUP HOT WATER SOURCES

Source	Heat ^{0}C	Debi lt/sn	Thermal Capacity kCA/h	Annual Fuel Equivalent m^3/year	Annual Earning (TL/year)	Can be heated number of houses
Vakÿfbahçe	49,5	2,00	140400	65876,83	20388,88	14
Zaini Nine	46,0	2,33	134200	62967,74	19488,52	13
Kupluce	42,0	0,30	12960	6080,94	1882,05	1
The Strangers Six	39,0	1,70	55080	25843,99	7998,71	6
Mr. Rÿfat	33,0	2,50	72000	33782,99	10455,84	7
Aydÿn Sülmen	28,0	0,30	8640	4053,96	1254,70	-
SSK	33,0	1,00	46800	21958,94	6796,29	5
Horhor	42,0	2,50	159000	74604,11	23089,97	16
Ethem Efendi	36,0	2,35	93060	43664,52	13514,17	9
Park with Pool	38,0	6,50	304200	142733,14	44175,91	30
Total					**149045,03**	**101**

2. Kaynarca Group Hot Springs

These resources are similarly used in the baths and heating systems of spa hotels. As can be seen in the table, the source temperatures and flow rates of this group are quite high, and it is stated that an economic value of approximately 351,000 TL per year can be obtained based on 2006 values.

[11] "Investigation of the Usability of Geothermal Energy in Bursa and its Surroundings" Akÿn Burak ETEMOÿLU et al.
Uludaÿ University Journal of Engineering and Architecture Faculty, Volume 11, Issue 1, 2006, Uludaÿ University, Faculty of Engineering and Architecture, Department of Mechanical Engineering, 16059, Görükle, Bursa

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TABLE 4-9: VALUES AND ECONOMIC CONTRIBUTION AMOUNT FOR KAYNARCA GROUP HOT WATER SPRINGS

Source	Temperature ^{0}C	Debi lt/sn	Thermal Capacity kCA/h	Annual Fuel Equivalent m^3/year	Annual Earning (TL/year)	Can be heated number of houses
Thermal water	82,5	8,5	1453400	681994,13	211077,18	145
Kara Mustafa	59,0	3,5	302400	141888,56	43914,51	30
Sulphurous	79,0	2,0	316800	148645,16	46005,68	32
Muhittin Baha	79,0	0,8	126700	59448,68	18399,37	13
Eshref Efendi	56,0	1,0	75600	35472,14	10978,63	8
Mevlevi Sheikh	35,0	1,0	36000	16891,50	5227,92	4
Bachelors' Bathhouse	51.5	1,0	59400	27870,97	8626,06	6
Hot Water Fountain	48	1,0	46800	21958,94	6796,29	5
Total					**351025,64**	**243**

3. Hot Springs Around Bursa

As shown in the table below, Bursa and its surroundings have very rich geothermal energy resources.
There are such hot springs. However, the hot springs, especially those in Yalova and Oylat (ÿnegöl), are not being utilized to their full potential. It has been pointed out that detailed studies have not yet been conducted on this group.

TABLE 4-10: YALOVA, OYLAT AND OTHER HOT WATER SPRINGS IN BURSA PROVINCE

Source	Heat 0C	Debi lt/sn	Thermal Capacity kCA/h	Annual Fuel Equivalent to m3/year	Annual Earning (TL/year)	Can be heated additional housing number
Armutlu	75,0	4,16	599040	281074,49	86992,55	60
Gemlik Hot Springs	36,0	8,63	32868	15421,94	477309	3
Yalova	65,0	20,30	2249640	1055549,56	326692,59	225
Oylat (Inegöl)	40,5	50,00	1890000	886803,52	274465,69	189
TOTAL					**692923,92**	**477**

Ultimately, Organic Rankin Cycle (ORC) and exergy calculations determine Bursa's total geothermal resource capacity in natural gas equivalent at 1,200,000 TL/year based on 2006 prices. Considering that Bursa's geothermal resources will be used for heating buildings, this value is significant.
It expresses.

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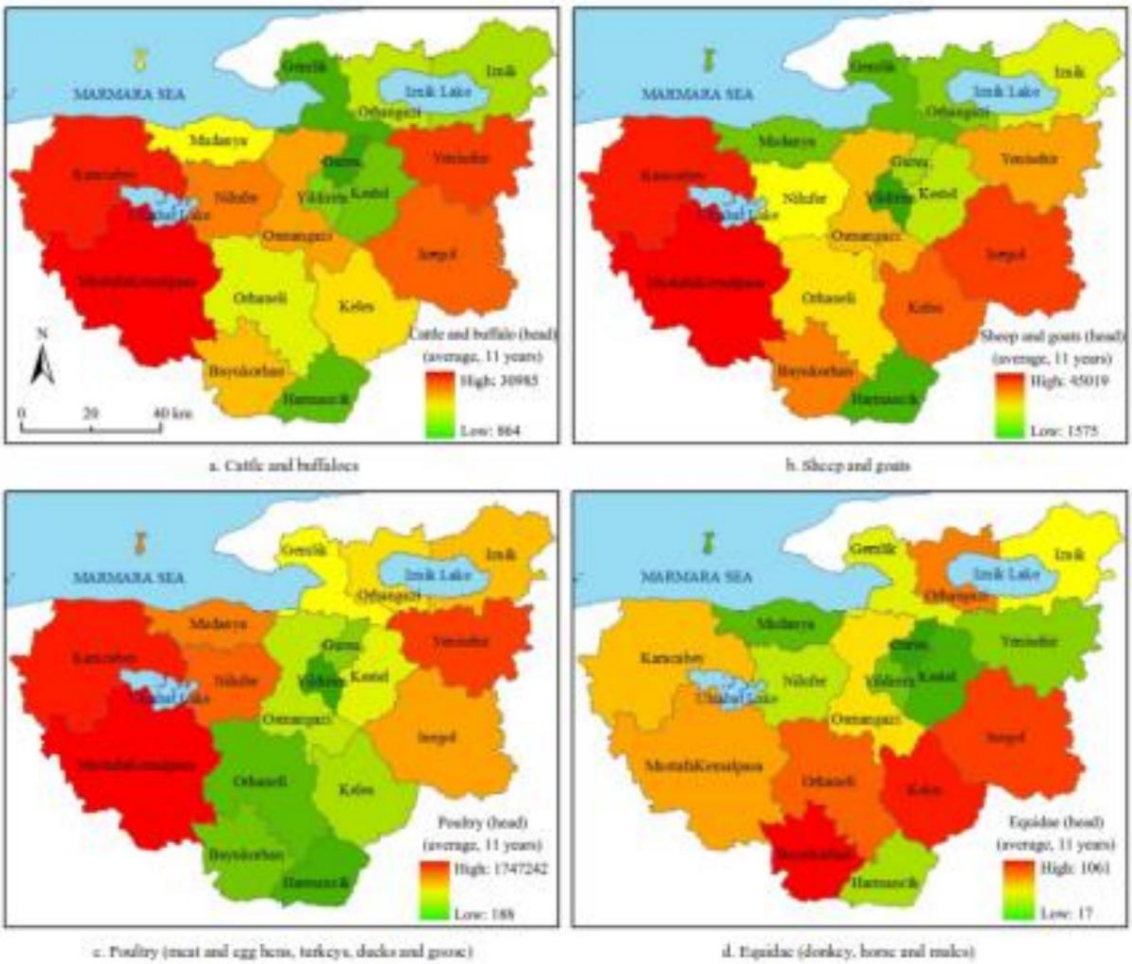
Bursa is a province with extensive agricultural areas, widespread modern agricultural practices, and consequently, food and related sectors occupy a significant place in the city's economy. Bursa's theoretical biofuel-based energy potential has been the subject of various research projects. Two of these have been evaluated in this study, and in particular, the feasibility report completed in March 2015 by the French companies ENEA and ESETA with the support of the French government for the Bursa Metropolitan Municipality has been the basis of BÿDEP's research.

Researchers Güksoy and Alibaÿ from Uludaÿ University Faculty of Agriculture have analyzed the energy potential of Bursa based on animal waste in detail using Geographic Information Systems (GIS) techniques.12 In the study, which included a breakdown of 11 years of animal population analyses by district, the population distributions shown below were determined.



a. Cattle and buffaloes

b. Sheep and goats

c. Poultry (meat and egg hens, turkeys, ducks and geese)

d. Equidae (donkey, horse and mules)

FIGURES 4-9: ANIMAL POPULATION DISTRIBUTION BY DISTRICT

This animal population distribution reflects averages from 2003-2013. Based on these averages, average animal waste and energy content were calculated for each district of Bursa in this study. One of the most interesting aspects of the study is the matching of animal population and waste-to-energy potential with, for example, the natural gas (heating) needs of different districts. In districts with high animal numbers, such as Büyükorhan and Karacabey, biogas production in these districts is shown to be more beneficial.

12 *GIS mapping of biogas potential from animal wastes in Bursa, Turkey, ÿlkbaÿ ÿ.-Özsoy G., Int J Agric & Biol Eng, 2015; 8(1): 74 83*

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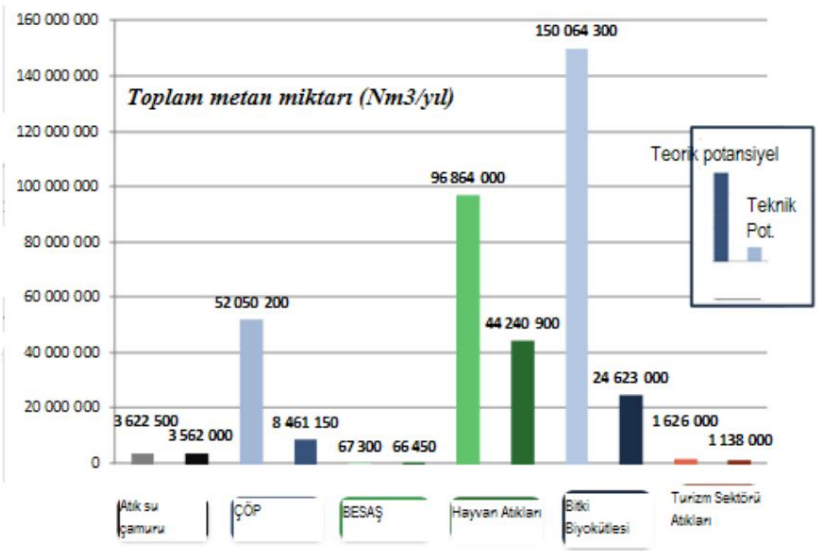
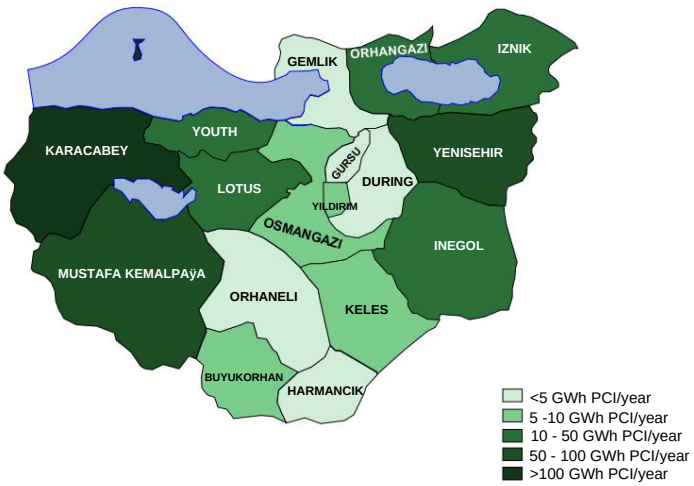
It has been observed that biogas can meet approximately 25% of the heating needs. Furthermore, it has been calculated that electricity generation from biogas could cover all of Bursa's electricity needs for lighting, public buildings, and irrigation. The direct use of local biogas production to meet energy requirements in the districts is of great importance.

The Climate Change Action Plan Report assesses the potential of various renewable energy sources to reduce greenhouse gas emissions. In this regard, the aforementioned 2015 report, prepared for Bursa Metropolitan Municipality with the support of the French government, was used as a basis because it evaluated a broader range of biofuel sources, including biomass energy, animal waste, and household waste potential. The animal waste and biomass energy potentials calculated in this report have been included in the reduction plan.

The summary results of the calculations made in the ENEA/ESETA study, based on the Bursa province, can be seen in the figure below.



In this study, 37% (831,000 tons/year) of animal waste and only 16% (401,000 tons/year) of plant biomass in Bursa province were utilized for technical potential. The following figure summarizes the distribution of bio-electricity technical potential from animal waste across districts.



FIGURES 4-10: BIO-ELECTRICITY PRODUCTION TECHNIQUES FROM ANIMAL WASTE BY DISTRICTS IN BURSA. POTENTIAL

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The table below summarizes the total available plant biomass and energy content.

TABLE 4-11: USABLE PLANT BIOMASS AND ENERGY CONTENT IN BURSA PROVINCE

N°	Material	Amount *tons/year*	Total CH4 *Nm3 / year*	Total energy *MWh/ year*
1	Grain waste	40.000	8.593.000	85.000
2	Tomato waste	239.000	5.019.000	50.000
3	Sugar beet leaves	40.000	1.565.000	16.000
4. Herbs that can be used for energy. (in unused agricultural areas)		82.000	9.446.000	94.000
Total		**401.000**	**24.623.000**	**245.000**

In conclusion, calculations including 37% of total animal waste and 16% of total biomass waste indicate a technical potential of 440,000 MWh/year and 245,000 MWh/year respectively, totaling 685,000 MWh/year. This figure represents approximately 7% of Bursa's total electricity consumption in 2014 and a very high 41% of the annual electricity consumption in residential areas, suggesting a very significant potential.

RENEWABLE ENERGY REDUCTIONS

Objective YE1: *To reduce the need for energy from fossil fuels in Bursa by expanding the use of renewable energy applications.*

Objective: *Clean energy through renewable energy applications.*

Stakeholders: *Ministry of Energy and Natural Resources, General Directorate of Renewable Energy, agricultural irrigation companies, storage facilities, large industrial enterprises with extensive facilities. The Regional Directorate of the Ministry of Forestry, renewable energy investors, financial institutions, building/ homeowners, and commercial enterprises.*

Objective YE1: Renewable energy applications – Solar energy
Action Plan YE1.1: Generating electricity from renewable sources through the use of solar energy in Organized Industrial Zones.
Action YE1.2: Renewable energy applications in municipal and subsidiary buildings.
Action YE1.3: Installation of solar energy systems in agricultural irrigation.
Action YE1.4: PV applications on building roofs
Action YE1.5: Renewable energy applications on the roofs of new Organized Industrial Zones

Action YE1.1: Electricity generation from renewable sources through the use of solar energy in Organized Industrial Zones. production	
Available Situation/Purpose	According to a study conducted by BTSO and Enverder, there are 10 million square meters of roof area in Organized Industrial Zones in Bursa. It has been calculated that covering 25% of this area with solar panels would generate a total of 2.5 GWh of electricity annually, given Bursa's abundant sunshine conditions.

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	In industrial PV applications, as in residential applications, prices are falling every year, and with the expected increase in electricity prices, the return on investment periods are also expected to decrease further. In 2014, industrial electricity consumption accounted for 17% of total urban electricity consumption. Besides energy efficiency, the use of renewable energy in industry offers significant potential for reducing the city's greenhouse gas emissions.
Activities /Steps	- Organized Industrial Zones should conduct feasibility studies on the subject. - In addition to individual industrial investments within Organized Industrial Zones (OIZs), OIZ managements can also become investors with the aim of using common areas or selling clean energy.
Timing	2016 - 2030
Cost	
Saving Quantity	Studies show that if 10% of the available rooftop solar panels are installed with PV systems by 2030, **a 250 MW PV** application would generate **250,000 MWh** of energy annually from renewable sources and reduce emissions **by 123,649 tCO2e .**
Investor	Organized Industrial Zones, industrial establishments
Stakeholders	Development agencies, various funds, financial institutions, PV manufacturers, and installation companies.
BBB Contribution	Regulations, facilitation
Risks	High initial investment cost.

Action YE1.2	**Renewable energy applications in municipal and subsidiary buildings.**
Available Situation/Purpose	Apart from the solar energy currently used by BUSKÿ, a subsidiary of Bursa Metropolitan Municipality, in its wastewater treatment plants, and the electricity produced from landfill gas at the Yenikent storage area of BBB (where a build-operate-transfer model is applied), The municipality does not have any significant renewable energy investments. While integrating renewable energy into existing buildings is more challenging, it is anticipated that implementing unlicensed photovoltaic power systems will reduce energy consumption and lower the municipality's electricity bill. Public institutions' renewable energy applications Currently Development by their agencies It is supported. Different financing options are available. Considering that other types will be introduced over time, BBB has the opportunity to install a considerable number of unlicensed PV systems in very different structures such as warehouses, workshops, facilities, parking lots, etc. The current legislation limits 1 MW.

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	It allows for unlicensed applications up to the installed capacity, and it is stated that this will be increased to 2.5 MW in the near future. It is projected that by 2030, BBB will be able to install a total of 2.5 MW of PV systems, both through rooftop systems and suitable ground applications. Together with other public institutions, a total of 25 MW of PV systems is expected to be installed. The electricity consumption of the municipality and its subsidiaries amounted to 82.8 million kWh in 2014. This represents 0.23% of the total energy consumption of the city. While the measures to be implemented may not have a significant impact on reducing the city's energy consumption, they can both set an example for citizens and provide guidance through the experience gained.
Activities /Steps	It is projected that by 2030, BBB will be able to install a total of 2.5 MW of PV systems, both through rooftop systems and suitable ground applications. Together with other public institutions, a total of 25 MW of PV systems is expected to be installed. Municipalities and/or their subsidiaries should conduct preliminary studies and feasibility analyses in areas where PV installations can be carried out.
Timing	2016 – 2030
Cost	Approximately €10-15 million
Saving Quantity	**25,000 MWh/year** of renewable energy production, saving **12,365 tCO2e.**
Investor	Bursa Metropolitan Municipality, other public institutions
Stakeholders	Local and international development agencies, financial institutions, PV manufacturers, and installation companies.
BBB Contribution	BBB is a direct investor. They are primarily required to conduct feasibility studies for the projects they will develop.
Risks	High initial investment cost.

Action YE1.3 Installation of solar energy systems in agricultural irrigation	
Available Situation/Purpose	Energy used for agricultural irrigation amounts to 66.4 million kWh, representing 0.2% of the city's total energy consumption. The agricultural sector, a significant source of livelihood for Bursa, faces numerous challenges, including high energy costs. is doing.
Activities /Steps	Raising awareness among villagers and farmers on the subject. Providing information on public incentives. Exploring funding opportunities
Timing	2016 - 2030
Cost	Approximately €3-4 million

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Saving Quantity	If 10% of total consumption were supplied by solar energy, that would be **6500 MWh per year.** The target is a reduction in emissions **of 3,215 tCO2e .**
Investor	Farmers, cooperatives
Stakeholders	Government incentives, financial institutions, PV manufacturers, installation companies.
BBB Contribution	Guiding light
Risks	Not available

Action YE1.4 PV applications on building roofs	
Available Situation/Purpose	At the forefront of distributed renewable energy applications, particularly in Bursa, are photovoltaic and heat pump applications. After a brief period of stagnation, the PV technology market is growing rapidly, driving down prices. As previously mentioned, while significant legislative shortcomings have been addressed, it is anticipated that it will take time for newly privatized distribution companies to adapt to distributed photovoltaic applications. Conversely, it is predicted that the falling prices of the technology and the rising electricity prices in Türkiye will lead to more reasonable payback periods for PV applications in residential settings starting from 2017. The Bursa city greenhouse gas inventory indicates that 58% of residential buildings are 1-2 stories high. This suggests that PV implementation is relatively easy in these 138,000 buildings compared to others.
Activities /Steps	If 7% of the 138,000 buildings were to have 3 kW PV systems installed, a total installed capacity of 30 MW would be achieved.
Timing	2019-2030
Cost	The cost of photovoltaic systems is rapidly decreasing, with price reductions of 8-12% occurring thanks to the market doubling every 2.5 years. This figure is an average estimate based on the expectation that by 2020, the average installed system price will fall below €0.5 per watt-peak. The total investment cost will be approximately €15 million. While there is considerable uncertainty in the photovoltaic system installation market, it is possible that these figures may be much higher than those calculated here due to dramatic price reductions. It is located.
Saving Quantity	The goal is to generate **30,000 MWh/year** of renewable energy and reduce emissions **by 14,838 tCO2e .**
Investor	Homeowners/building owners
Stakeholders	Various international funding sources, institutions that provide green financing opportunities, PV system manufacturers and installers
BBB Contribution	The municipality can guide citizens on this matter, providing assistance with network connections and communication with producers.

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Risks	Frightening legal details,

Action YE1.5: Solar energy applications on the roofs of new Organized Industrial Zones.	
Available Situation/Purpose	Meeting the energy needs of new Organized Industrial Zones (OIZs) with local and renewable resources will be critical in terms of industrial emissions. Therefore, the goal should be for the new OIZs to be established in Bursa to partially meet their own electricity needs.
Activities/Name Imlar	It is becoming a rule that at least 20% of the electricity needs of all newly established Organized Industrial Zones (OSBs) must be met by photovoltaic systems (figures announced by BTSO).
Timing	2016-2030
Cost	Photovoltaic installation costs: 300-400 million Euros (cost reductions taken into account, efficiency increases not included)
Saving Quantity	The target is to generate **688,708 MWh/year** of renewable energy and reduce emissions **by 340,633 tCO2e .**
Investor	Industrial establishments
Stakeholders	Various funds, institutions providing green financing opportunities, PV system manufacturers and installers, industrial organizations, and organized industrial zone management.
BBB Contribution	Local governments have included the requirement for new industrial zones to partially generate their own energy as a condition for permits. The municipality can guide citizens on this matter, assisting with grid connection and communication with producers.
Risks	Delays in legal regulations,

Objective YE2: *To reduce the need for energy from fossil fuels in Bursa by expanding the use of renewable energy applications.*

Objective: *To increase the use of clean energy through renewable energy applications.*

Stakeholders: *Ministry of Energy and Natural Resources, General Directorate of Renewable Energy, Private sector. Local government*

Objective YE2: Energy production from animal and agricultural waste.
Action YE2.1: Energy production from agricultural and animal waste.

Action YE2.1 Energy production from agricultural and animal waste.	
Available Situation/Purpose	Agriculture and food sectors, being the most important economic sectors of Bursa, also possess significant renewable energy potential in terms of animal and plant waste. As stated in the relevant section of the report, the numerical values on this subject were obtained from consulting firms with the support of the French government.

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	This information is taken from a study prepared by ENEA-ESETA for Bursa Metropolitan Municipality.
Activities /Steps	Feasibility studies need to be conducted for energy production from animal and agricultural waste equivalent to 40 million m3 of natural gas.
Timing	2017-2030
Cost	
Saving Quantity	The goal is to generate **383,200 MWh** of energy and reduce emissions **by 77,598 tCO2e .**
Investor	BBB or private investors
Stakeholders	Farmers,
BBB Contribution	They can be investors, but they can also guide and encourage the private sector.
Risks	High initial investment costs.

Objective YE3: Biogas production from wastewater treatment sludge.
Action YE3.1: Biogas production from wastewater treatment sludge.

Action YE3.1 Biogas production from wastewater treatment sludge.	
Available Situation/Purpose	Currently, wastewater treatment sludge is disposed of by being sent to solid waste landfills.
Activities /Steps	In wastewater treatment plants, biogas should be produced in the digesters to be installed, and subsequently, renewable energy should be generated while disposing of waste sludge.
Timing	2017 - 2030
Cost	
Saving Quantity	The goal is to generate **22,205 MWh** of energy and reduce emissions **by 3,195 tCO2e .**
Investor	BUSKI
Stakeholders	BUSKÿ, BBB
BBB Contribution	Support to BUSKÿ on various issues.
Risks	Initial investment cost

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OTHER MITIGATING MEASURES DISCUSSED AT THE WORKSHOP

The following mitigation measures were proposed by the relevant working group at the workshop on September 10, 2015, but could not be quantified.

- The use of biofuels as an alternative to fossil fuel-based power plants.
- Algae-based energy production
- Obtaining energy through pyrolysis
- Electricity generation via pressure sensors

4.1.4 SOLID WASTE AND WASTEWATER MANAGEMENT

According to the Bursa Integrated Solid Waste Management Plan prepared by the Bursa Metropolitan Municipality, in 2014, 88% of the household waste generated in Bursa was disposed of at the Yenikent and ÿnegöl Solid Waste Landfills, while 12% was disposed of at unregulated landfills. According to the Address-Based Population Registration System (ADNKS) data, the population of Bursa in 2014 was 2,787,539. Surveys conducted in the districts revealed that waste services were provided to 2,730,838 people in 2014. This figure indicates that the waste collection efficiency in Bursa province is 98%.

Waste from Osmangazi, Yÿldÿrÿm, Nilüfer, Mudanya, Gürsu, Kestel, Gemlik, Karacabey, Kemalpaÿa, and Orhangazi districts arrives at the Yenikent Solid Waste Landfill, while waste from Yeniÿehir and ÿnegöl districts arrives at the ÿnegöl Landfill. Orhaneli, Büyükorhan, Harmancÿk, Keles, and ÿznik districts dispose of their waste in an uncontrolled manner. According to 2014 data, 2,084 tons/day of waste is sent to the Yenikent Solid Waste Landfill, 168 tons/day to the ÿnegöl Solid Waste Landfill, and 348 tons/day to uncontrolled dumping sites. To end the uncontrolled dumping practices carried out by 5 districts, primarily the mountainous districts, transfer stations are being constructed to reduce the distances required to transport the districts' solid waste.

The plan envisages the construction of four transfer stations: one in the east, one in the west, one in the north, and one in the south.

According to Law No. 5216 on Metropolitan Municipalities, the collection of household waste at its source is the responsibility of the district municipalities, while the evaluation and disposal of this waste, including transfer stations, is the responsibility of the Bursa Metropolitan Municipality. Changes made and to be made to the legislation within the framework of harmonization with the EU necessitate separate collection and dual collection at the source to expand and improve recycling and reduce the entry of organic matter into landfills. In this context, the importance of collection is further increased. According to the Regulation on the Regular Disposal of Waste, it is foreseen that 75% of the biodegradable waste generated in 2005 will be accepted for regular landfills in 2015, 50% in 2018, and 35% in 2025.

Yenikent Solid Waste Landfill: Located within the Osmangazi district, this landfill receives waste from the districts in the central region. The facility began accepting waste from the Osmangazi district in 1995. It is planned to be in use until 2025.

Inegöl Solid Waste Landfill: The municipalities of Inegöl and Yeniÿehir transport their waste to the landfill in Inegöl. The Inegöl landfill began accepting waste in 2011 and is planned to be used until 2037.

Irregular Landfill Sites: The districts in the south of Bursa province (Orhaneli, Keles, Harmancÿk, and Büyükorhan) and the ÿznik district dispose of all their waste using irregular landfill methods.

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Of the 29 irregular waste disposal sites identified in 2014, the rehabilitation of 7 was completed in September 2015. Once the rehabilitation work is complete, no waste will be accepted at these sites.

Landfill Gas Management: The Yenikent Solid Waste Landfill energy production facility (Build-Operate Model) was awarded to ITC Bursa Energy Production Industry Trade Inc. in 2010 for a period of 29 years. The facility was commissioned in 2012. Since 2012, the facility has been producing approximately 9.8 MWh of electricity per hour from about 5,400 m3 of landfill gas. A Renewable Energy Production License has been obtained from the Energy Regulatory Authority (EPDK) for the electricity produced. The facility, operating at full capacity, has one combustion chimney and a flue gas cleaning system to be used to burn the gas in the lines during periods of interruption in energy production.

FIGURE 4-11: YENIKENT SOLID WASTE REGULAR LANDFILL SITE AND ENERGY PRODUCTION FACILITY

Objective AA1: *To achieve greenhouse gas reduction at solid waste landfills.*

Objective: *To reduce emissions from landfills, which account for 1% of CO2e* emissions.

Stakeholders: *BBB (Istanbul Metropolitan Municipality), District Municipalities, financial institutions, companies producing energy from landfill gas.*

Objective AA1: ***To achieve greenhouse gas reduction at solid waste landfills.***
Action AA1.1: Converting all illegal dumping sites into regulated landfills. and energy production

Action AA1.1: Rehabilitation of all illegal waste disposal sites, transformation into green areas, and energy production.	
Available Situation/Purpose	With the project currently being carried out by the municipality, all illegal dumping sites will be closed and the waste will be sent to the Yenikent and ÿnegöl regulated landfills. The waste remaining in the existing sites should be rehabilitated and converted into regulated landfills, and the methane gas produced should be burned or used to generate energy.
Activities /Steps	Conducting a feasibility study

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Timing	2027-2030
Cost	
Saving Quantity	The target is a reduction in **99,141 tCO2e** emissions.
Investor	BBB, LFG plant investors
Stakeholders	District municipalities, energy production companies
Risks	High initial investment cost

Objective AA2: *To reduce the amount of waste going to landfills.*

Objective: *To reduce greenhouse gas emissions by separating solid waste at the source.*

Stakeholders: *BBB (Istanbul Metropolitan Municipality), District Municipalities, financial institutions, companies producing energy from landfill gas.*

Objective AA2: Separating solid waste at source.
Action AA2.1: Separation and recycling of solid waste at source.

- Increasing the recycling rate by ensuring the separation of waste at the source, primarily household waste, into organic and recyclable waste (packaging waste), thereby reducing the amount of waste going to landfills and increasing disposal and recycling rates.

- The aim is to utilize industrial waste quantities as production inputs for other industries, to encourage symbiotic production between industries, and to transform existing Organized Industrial Zones (OSBs) to facilitate symbiotic production.

Objective AA3: To achieve greenhouse gas reduction in wastewater treatment plants.

Objective: *To improve operating conditions and reduce greenhouse gas emissions by producing biogas and energy from waste sludge.*

Stakeholders: *BBB (Istanbul Metropolitan Municipality), District municipalities*

Objective AA3: ***To achieve greenhouse gas reduction in wastewater treatment plants.***
Action AA3.1: Improving the operating conditions of all wastewater treatment plants.

Action AA3.1: Improving the operating conditions of all wastewater treatment plants.

Improving operating conditions in 90% of existing municipal wastewater treatment plants and generating biogas and energy from wastewater treatment sludge is expected to reduce greenhouse gas emissions by 90%, resulting in a projected reduction of **87,828 tons of CO2e** by 2030.

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OTHER MITIGATING MEASURES DISCUSSED AT THE WORKSHOP

The following mitigation measures were proposed by the relevant working group at the workshop on September 10, 2015, but could not be quantified.

- Encouraging best practices in industrial waste and water management, ensuring the effectiveness of legislation in practice through audits, and increasing awareness campaigns regarding waste and water management.

- Ensuring sustainability by creating flood and drought action plans, rainfall Measures should be taken to ensure that the water is considered as usable water.
- Reducing water consumption
- Increasing greywater utilization and wastewater recycling
- Treating wastewater to make it suitable for use in irrigating green areas.

4.1.5 INDUSTRY AND SERVICES

Turkey, as an OECD member and a transition economy, is a country with unique dynamics, including a young population, growing production, and technological infrastructure. Within this framework, it requires diverse resources, primarily for employment, increased competitiveness, improvement of public services, and similar areas. Industry in Türkiye, with its 20-25% share of GDP and significant impact on growth rates, is an indispensable resource for sustainable development. The industrial sector's contribution to the country's development and growth is crucial.

In the context of competitiveness, there is a significant impact on resource consumption, greenhouse gas emissions, and climate change. It has an effect.

Greenhouse gases resulting from activities in the industrial sector can be examined under two headings: production-related and energy-related. The industrial sector's share in Türkiye's final energy consumption is approximately 37%. The industrial sector's energy-related greenhouse gas emissions...
The level of emissions depends on the amount of CO_2 released for the electricity generation it uses and the distribution of fuel types used in the sector. Figure 4.12 below shows the distribution of energy used in the industrial sector by fuel type. The distribution by type is given. The increase in coal consumption is more than 6 times.
This is observed. Furthermore, the use of waste as fuel in industry is quite low. This situation...
In addition, carbon emissions from the electricity sector indirectly affect the industrial sector. Therefore, renewable and low-carbon emission sources in the electricity sector are important.
It is predicted that the increasing importance of these technologies will have a significant impact.

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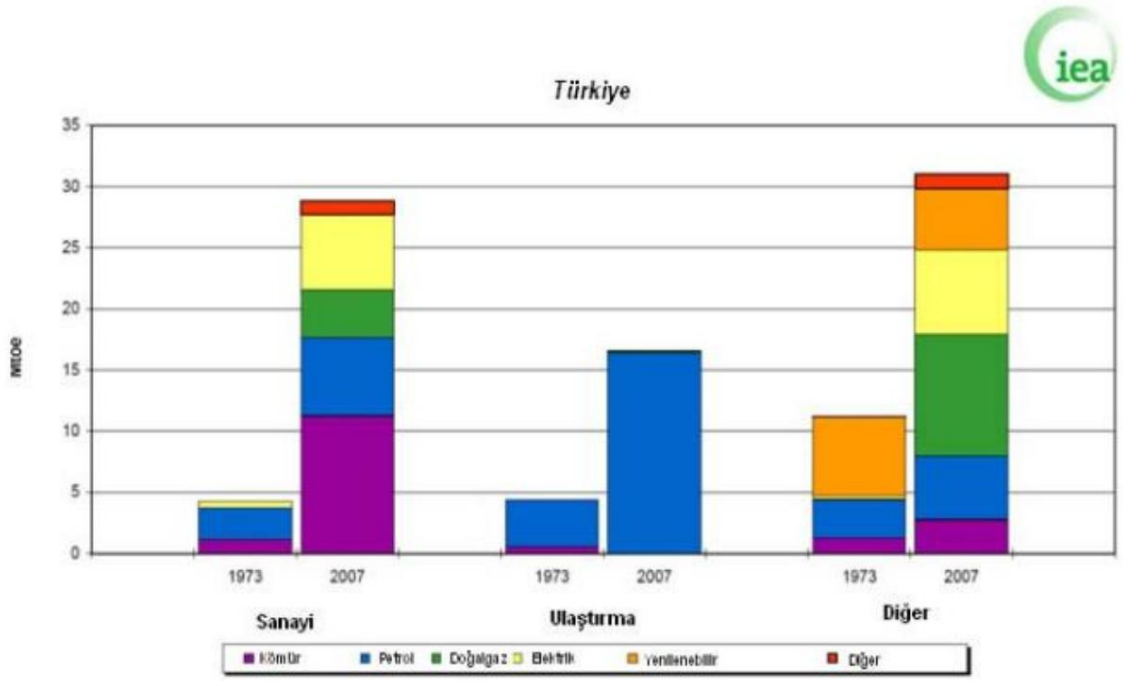

FIGURE 4-12: DISTRIBUTION OF ENERGY CONSUMPTION IN INDUSTRY BY FUEL TYPE (IEA)

When evaluating the efficiency of industrial energy consumption, it is seen that there is significant potential in this area as well. According to the Energy Efficiency Strategy document prepared under the coordination of the Electricity Works Survey Administration (EÿEÿ), within the scope of harmonization studies with the European Union, the European System of Accounts (ESA-95) was adopted in 2008 as part of the changes made in the field of statistics. In light of these studies, in 2008; 282 liters of oil equivalent of primary energy and 0.53 kWh of electricity energy were consumed per $1000 of GDP, based on gross consumption. In OECD countries, the same values are around 200 liters and 0.4 kWh respectively. In addition, when the effect of growth on energy consumption is examined, it is seen that in the period 1999-2008; While Gross Domestic Product (GDP) increased by 51.1% at constant prices (annual average: 4.2%), electricity consumption increased by 75% in residential areas (annual average: 5.8%), 190% in the commercial sector (annual average: 6.6%), and 65.6% in industry (annual average: 5.2%). Between 2004 and 2008, while the industrial production index increased by 14.5%, industrial electricity consumption increased by 30%. The structure of Turkish industry consists of many sub-sectors with different characteristics. When examined in terms of production share, the food sector leads with 18.8% and the textile sector with 16.3%. These sectors are followed by the petroleum products sector with 8.8%, and the iron The automotive sector follows with 6.2%, and the chemical sector with 5.8%.

Turkey is identified by various national and international institutions as having high potential in terms of energy efficiency. According to data from the International Energy Agency, Turkey has an energy intensity of 0.38, placing it among the top OECD countries. It is twice the average. Various studies are being conducted to increase energy efficiency in the industrial sector and, consequently, to reduce greenhouse gas emissions that contribute to climate change. gas emissions reduction

Energy audits and surveys are being conducted. The results indicate that the potential for energy savings in industry is at least 20%.

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TABLE 4-12: SAVINGS POTENTIALS OF DIFFERENT SECTORS

Sector	Industry Energy Consumption Rate (%)	Projected Energy Savings Potential (%)
Iron and Steel	26	22
Stone – Earth (cement, ceramics, glass)	20	20
Petrochemicals	12	20
Textile	7	20
Food	6	25

Source: World Energy Council – Turkish National Committee Report, 2007

INDUSTRIAL STRUCTURE IN BURSA

Looking at Türkiye's export structure, it is evident that the prominent sectors are also those that hold significant weight within Bursa's economy. Among these sectors, textiles and ready-made clothing, motor vehicles (automotive), and food stand out in Bursa due to their production and employment values, as well as their share in exports. Bursa accounts for approximately 18% of the country's automotive and machinery exports. With a 10% share in textiles and ready-made clothing, Bursa also achieves considerable export figures in other sectors relative to its population.

The data published annually since 1997 by the Bursa Chamber of Commerce and Industry for the top 250 companies in Bursa by turnover provides detailed information about the sectoral structure in Bursa. The change in the share of each sector in the top 250 companies in Bursa, in terms of the number of companies, over the years is shown in Figure 4.13 below.

Between 1997 and 2014, significant changes occurred in the sectoral structure. Companies in all sectors located in Bursa are affected by Türkiye's economic structure and global changes or crises. However, the degree of this impact varies depending on the sector.

The textile and ready-made clothing sector, traditionally the most important sector in Bursa, has been operating since 2001.
It is constantly declining, and consequently, the number of companies entering the top 250 is decreasing. Since 2007, the automotive sector seems to have taken the lead in this area. A similar change is observed in the employment sector as well.13

13. *Bursa 2030 Environmental Planning Plan, 1/100,000 Scale, Synthesis Report, Bursa Metropolitan Municipality 2012*

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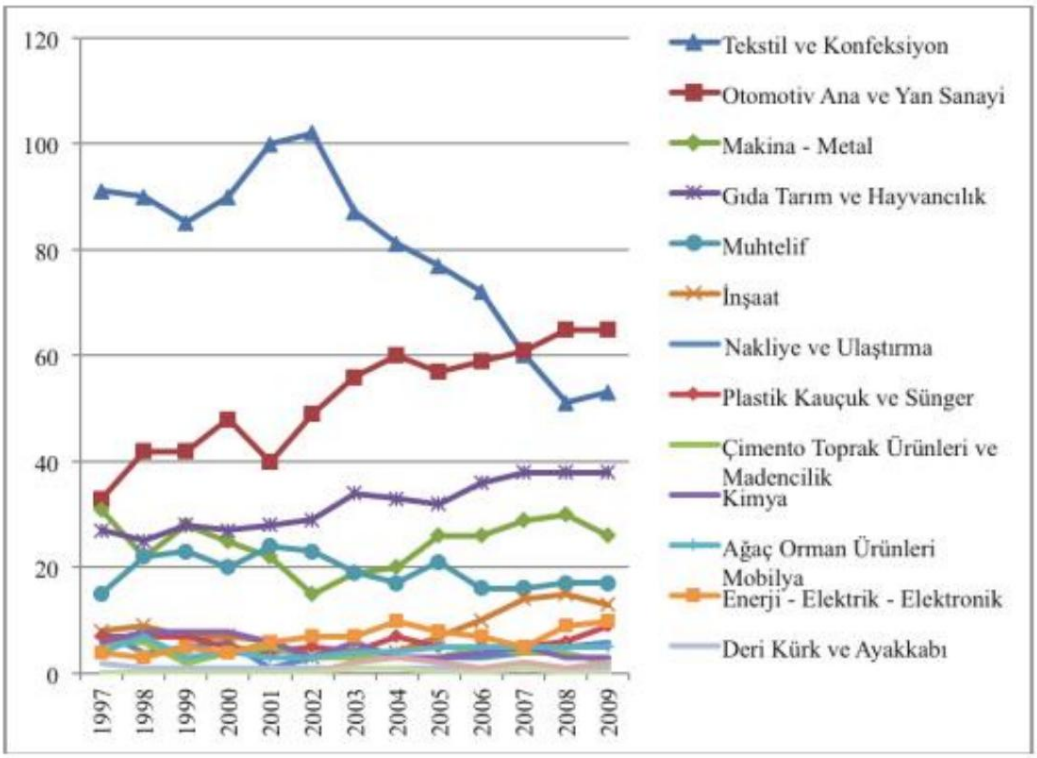

FIGURE 4-13: BTSO, SHARE OF SECTORS AMONG THE TOP 250 COMPANIES (BTSO)

It can be safely said that the structure of Bursa's industrial sectors will change even further over time. Due to the continued concentration of migration and investments throughout the region, pressure for spatial growth will persist. In this region, which will maintain its importance within the national economy, intra-regional input-output relationships will increase along with transportation investments.

In line with national strategies and company preferences, the automotive sector is located in the Eastern Marmara Region. The accumulation will continue. Production volume and product variety will increase. However, competition will also increase. As a result, companies with low production volumes either shift to new products or leave the region. It may be necessary.

In the textile sector, pressure to relocate polluting industries outside of Istanbul is expected to continue, creating pressure on surrounding provinces. However, waste management will be more successful than in the past with the implementation of a clean production plan. Public pressure on polluting activities is expected to increase. The ready-made clothing and garment sector is more easily relocated than sectors like the automotive industry. In this context, the emergence of rapidly growing or shrinking new settlements should be expected depending on fluctuations in energy costs.

These new growth centers will emerge in provinces or districts adjacent to existing growth centers. However, businesses involved in artificial fiber production, etc., are expected to maintain their presence in Bursa. Çanakkale – Competition in the food sector is expected to increase between Balýkesir and Bursa provinces. Practices such as organic farming will come under pressure due to newly constructed transportation and energy infrastructure. However, the continued population growth throughout the Marmara Region will lead to growth in these sectors. It is expected to continue.

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ENERGY EFFICIENCY POTENTIALS OF INDUSTRIAL SECTORS IN BURSA

In Turkey, the average energy efficiency potential in industrial sectors is estimated to be around 20% .14 In contrast, the industrial sector in Bursa differs from the Turkish average, as shown above with excerpts from the Synthesis Report, and requires studies with higher resolution to determine energy usage characteristics. A good example of such a study is the detailed energy efficiency field research conducted by Enervis in 17 companies in the Bursa Organized Industrial Zone (BOSB).

Enervis's results, published in January 2015, show that the energy efficiency potential in perhaps the most significant industrial sectors of Bursa is far above the national average. The research, conducted in 17 firms (11 in the automotive sector and 6 in the textile sector) with grant support from the Ministry of Economy, demonstrated that savings of up to 24% in MWh are possible through the implementation of cost-effective energy efficiency measures. The average payback period for energy efficiency implementation projects in both sectors analyzed is calculated as 1.5 years. The distribution of gains in the textile sector, reaching 25%, is as follows:

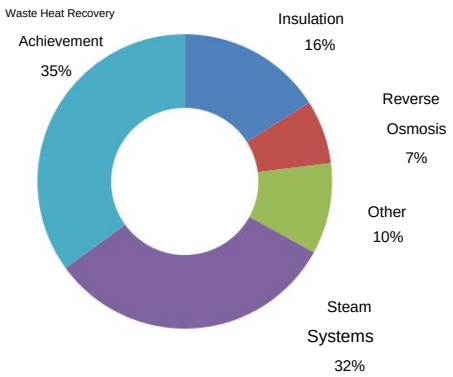

FIGURE 4-14: DISTRIBUTION OF ENERGY GAIN RATES IN ENERVIS TEXTILE CLUSTER

According to Enervis' study, the distribution in the automotive cluster, which has a 20% energy saving potential, is shown below.

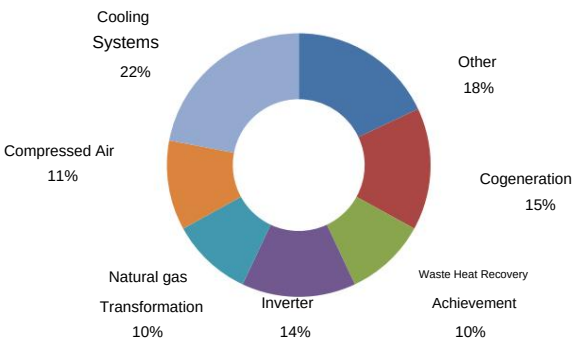

FIGURE 4-15: DISTRIBUTION OF ENERGY PROFIT RATES OF ENERVIS AUTOMOTIVE CLUSTER

The added value created by the industrial sector, in particular, is significantly above the national average. When the sectoral added values of the region are examined over the years, it is seen that, as in the country as a whole...

14. *Development of Turkey's Climate Change Action Plan Project: Buildings Sector - Current Situation Evaluation Report, Tülin Keskin, August 2010*

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For example, the decline in the agricultural sector and the increase in the services sector are noteworthy. The region also ranks second after Istanbul in terms of industrial value added among the top 5 regions in the country that generate the most added value.

In terms of total number of businesses, Bursa ranks second nationwide with 8%, after Istanbul (31%). Bursa's strengths in the sector indicate a significant increase in trade and services in the coming years. Developments in industry and agriculture will increase the workforce and the number of firms in trade and services. The services sector serves both of these sectors, as well as firms within it and other service companies. Accordingly, services exhibit a dynamic of growth driven by both internal growth and growth in non-sectoral activities. In Bursa, a significant increase in the services sector is expected, driven by the province's internal dynamics, its position as the strongest province in the TR 41 region, and its potential to become a center for trade and services for neighboring provinces. This increase could encompass both business services and community services.

The service sector, which will be developed in the districts with the aim of providing inter-center hierarchical structure, will also help the efficient operation of production and distribution activities in the agricultural sector.

While local governments cannot directly influence energy efficiency practices in the industrial sector, they can be selective in terms of land use, permits, and licenses for newly established facilities. However, local governments also feel the pressure of employment and economic growth, reducing their likelihood of being selective in this regard. Nevertheless, examples of municipalities encouraging, guiding, and even compelling energy-saving behaviors and investments among all institutions, organizations, and even citizens within their regions are common worldwide.

ENERGY EFFICIENCY IN INDUSTRY IN BURSA

In Bursa, where industry is largely located in Organized Industrial Zones (OIZs), the proposal for industry to generate its own electricity using local renewable energy sources is highly economically feasible. The total electricity consumption of the 11 largest OIZs amounts to 3.2 billion kWh per year. It is stated that in the new generation OIZs to be established, 20% of the total consumption will be met by renewable energy sources.

Objective: *To reduce Bursa's energy needs through energy-efficient facilities in the industrial sector.*

Objective: *To achieve energy savings and emission reduction through energy-efficient practices.*

Stakeholders: *Organized Industrial Zones, all industrial enterprises, BBB (Business Development and Investment Bank), financial institutions, electro-mechanical application companies, material and equipment manufacturers.*

Objective S1: Energy Efficient Systems
Action S1.1: Reducing Energy Consumption through Energy Efficiency Applications in Industry

Action S1.1	Reducing Energy Consumption through Energy Efficiency Practices in Industry
Available Situation/Purpose	Industrial fuel and electricity consumption and greenhouse gas emissions account for 32% of total urban emissions. The studies mentioned above reveal the energy efficiency measures and savings rates in the city's main industrial sectors, automotive and textile-clothing.

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	Rising energy prices reduce the payback period for any improvements made in industrial facilities with very high energy consumption. Furthermore, reducing consumption of fossil fuels, which are sometimes difficult to supply, helps organizations reduce their risks.
Activities /Steps	- Energy audit studies should be initiated in industrial facilities. - Transitioning to the ISO 50001 Energy Management System, which is also necessary to receive government support, and starting to monitor energy consumption in detail are among the important steps that industrial organizations can take to control their energy consumption. - Encouraging the transition of industry to clean production. All studies resulted in a 25% energy saving.
Timing	2016 - 2030
Cost	Since each industrial facility will have a different technological infrastructure, costs will vary considerably.
Saving Quantity	Annually, the goal is to **save 2,284,527 MWh of electricity, 1,230,386 MWh of natural gas, 200,369 MWh of coal, and 17,993 MWh** of fuel oil, resulting in a total energy saving **of 3,733,275 MWh** and a reduction in emissions **of 1,473,191 tCO2e .**
Investor	Industrial establishments, Organized Industrial Zones
Stakeholders	BBB, Ministry of Science, Industry and Technology, financial institutions, funding sources,
BBB Contribution	Guiding, enlightening
Risks	Lack of awareness, high initial investment cost.

OTHER MITIGATING MEASURES DISCUSSED AT THE WORKSHOP

The following mitigation measures were proposed by the relevant working group at the workshop on September 10, 2015, but could not be quantified.

- Increasing legislative oversight regarding the controlled incineration of industrial waste.
- Widespread adoption of centralized system applications in industry
- Reviewing and implementing cooperative processes for energy consumption. start
- Industry should focus its R&D efforts on reducing greenhouse gas emissions.
- Organizing training sessions to raise awareness among employees and their families about energy consumption and efficiency.
- Promoting the widespread adoption of energy and waste minimization practices in industrial applications.
- Developing incentive systems for emission reduction (tax exemptions, etc.)
- Development Agency's project applications regarding renewable energy and industrial energy efficiency to create
- Initiating labeling practices related to greenhouse gas emission reduction in products.

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4.1.6 AGRICULTURE, LIVESTOCK AND FORESTRY

Bursa's favorable physical location and climate conditions contribute to its rich agricultural structure in terms of quality, variety, and quantity. Within agricultural activities, plant production surpasses animal production in terms of volume and value. Agricultural production is largely carried out by small businesses. The use of machinery in the agricultural sector is showing a significant increase. The agricultural sector provides significant employment in Bursa. The agricultural products created in Bursa also contribute to the development of the food industry, where these products are processed and utilized.

This is the reason.

The cultivated land area used for agriculture in Bursa is 477,094 hectares. Agricultural production in Bursa is increasing every year. Productivity is key. The main reasons for this include the use of new technologies, increased irrigation facilities and expansion of irrigated land, the emphasis placed on fertilizers and pesticides, and the application of scientific methods in agriculture.

The most important agricultural products produced in Bursa are wheat, barley, sugar beet, potatoes, onions, tobacco, tomatoes, peppers, grapes, olives, peaches, apples, and pears. Additionally, 600 tons of raw silk cocoons are produced annually.

In the city, where nearly half of the total surface area is classified as forest, a significant portion of agricultural land is located in the east. It is located in the western districts and the Bursa plain.

Within Bursa's cultural land assets, agricultural land takes the first place in terms of area. Vegetables
Almost all of the olive groves located after these areas are situated within the borders of Mudanya, ÿznik, Orhangazi and Gemlik districts, which are defined as bay districts.15

TABLE 4-13: DISTRIBUTION OF IRRIGATED LAND

	Irrigated Area
Agricultural Land	365,217 ha
Irrigable land	286,640 ha
Land irrigated by DSI (State Hydraulic Works)	65,940 ha
Land irrigated by the Provincial Special Administration	25,904 ha
Land irrigated by producers	54,644 ha
Total Irrigated Land	**146,488 ha**

Livestock farming

Bursa is home to milk processing plants (Sütaÿ, Eker, Nestle, Golf) that supply products to the national market.
Dairy farming, in particular, has gained momentum over the years and reached significant capacity. The establishment of economically viable facilities meeting EU standards has led to an increase in the number of purebred and crossbred cattle. The proportion of purebred and crossbred cattle within the total cattle population has reached 95%.

15 Bursa Commodity Exchange, Agriculture in Bursa, 2013

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The uncontrolled disposal or storage of agricultural and animal-derived organic waste leads to odor formation and pollution of groundwater and surface water.
Approximately 11 billion tons of animal waste are generated annually in Türkiye. Utilizing this waste is crucial for both the national economy and environmental health.

When waste is stored in open areas, methane gas (CH4) is released during the natural decomposition process. Decomposition water also forms lakes and mixes with the soil. Because this water contains high amounts of nitrogen, nitrate, and phosphate, it pollutes the soil. The polluted water filtered during the decomposition process mixes with groundwater and reaches the seas. This causes seawater pollution and algal blooms.

Objective: To achieve greenhouse gas reductions in agriculture through sustainable practices.
Objective: *To reduce greenhouse gas emissions.*
Stakeholders: *Farmers, cooperatives, Ministry of Food, Agriculture and Livestock*

Objective THO1: Reducing the Use of Chemical Fertilizers
Action THO1.1: Reducing the Use of Chemical Fertilizers

Action THO1.1 Reducing the Use of Chemical Fertilizers	
Available Situation/Purpose	During the workshop, it was learned from the Provincial Directorate of Agriculture officials that 94,100 tons of chemical fertilizers were used in Bursa province in 2014. This release of 318,999 tons of CO2e into the atmosphere corresponds to 2.5% of the city's total CO2 inventory. The goal is to reduce chemical fertilizer use by 20% by 2030.
Activities /Steps	• Promoting the use of natural fertilizers • Training and raising awareness among farmers on the subject. • Organic solids released after biogas production from animal and agricultural waste and the use of liquid fertilizer in agricultural fields • Disposal of organic waste through composting and other recycling technologies the subsequent use of organic fertilizer in agricultural fields
Timing	2016-2030
Cost	
Saving Quantity	A reduction in emissions **of 63,800 tCO2e** is projected.
Investor	Farmers, Municipality (biogas plants), Provincial Directorate of Agriculture
Stakeholders	Farmers, BBB (Bursa Metropolitan Municipality), Provincial Directorate of Agriculture, Ministry of Food, Agriculture and Livestock.
BBB Contribution	Investor, guide
Risks	Lack of information, high initial investment costs, social acceptance.

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The goal of THO2: To reduce animal waste.
Action THO2.1: Reducing animal waste.

Action THO2.1 Reducing animal waste	
Available Situation/Purpose	Emissions from animal waste management amount to 79,677 tons of CO2e, representing 0.6% of total emissions.
Activities /Steps	The disposal of animal waste is envisioned through model disposal techniques such as biogas production and composting. This action is related to the biogas production reduction target planned in Action YE2.1. The goal is to reduce emissions from animal waste by 50%.
Timing	2018 – 2030
Cost	
Saving Quantity	A reduction in emissions **of 39,838 tCO2e** is projected.
Investor	Municipality, farmer
Stakeholders	Farmers, BBB (Bursa Metropolitan Municipality), Provincial Directorate of Agriculture, Ministry of Food, Agriculture and Livestock.
BBB Contribution	Investor, guide
Risks	Lack of information, high initial investment costs, social acceptance.

Objective THO3: Land consolidation and/or shared vehicle use through cooperatives increase
Action THO3.1: Increasing shared vehicle use through land consolidation and/or cooperatives.

The division of land through inheritance and/or sale has resulted in inefficient agricultural practices.
In addition, idle capacity and productivity losses occur due to the lack of shared use of agricultural machinery.

- Increasing land consolidation activities,
- Choosing and sharing fuel-efficient vehicles,
- Use of new agricultural techniques (no-till farming and similar)
- Increasing the use of renewable energy in agriculture (using solar energy for irrigation, (biogas use, etc.).
- Creating economies of scale by establishing agricultural cooperatives or reactivating existing ones; increasing the sharing of resources and manpower; and transitioning to efficient agricultural practices.

- Zoning plans should be prepared according to agricultural areas, and agricultural lands should not be used for purposes other than agriculture.

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- In land board decisions, care should be taken to ensure sensitivity to non-agricultural use.

It is predicted that greenhouse gas emissions from agriculture will decrease with measures such as these.

OTHER MITIGATING MEASURES DISCUSSED AT THE WORKSHOP

The following mitigation measures were proposed by the relevant working group at the workshop on September 10, 2015, but could not be quantified.

- Making unproductive areas in forest regions productive and converting them into carbon sinks

  Efforts to increase [increase/improvement] should continue.
- Efforts to prevent damage caused by wild animals to agricultural areas and plants.

  It should be done.
- Agricultural and forest areas should not be damaged when constructing wind power plants.
- The public should be educated and public awareness should be raised regarding the protection of forest areas (fires).
- Waste generated in forest and non-forest areas should be used in energy production (biomass,

  pellets, etc.
- Private forest areas should be increased.
- The inefficiency in forests caused by the irregular use of groundwater must be prevented.

4.1.7 AWARENESS CAMPAIGNS

Objective: *To raise awareness of energy conservation at the point of consumption, to encourage the purchase of energy-efficient electrical devices, to provide technical support when it comes to investment, and to promote fuel savings through economical driving methods.*

Target: *Achieving 5% energy savings in 50% of homes, resulting in 255,455 MWh and* ***81,993 tons of CO2e.***

75% of commercial buildings can achieve a 5% energy saving, generating 148,360 MWh of energy and reducing the amount of CO2e emitted.

Stakeholders: *BBB (Istanbul Metropolitan Municipality), district municipalities, citizens, vehicle owners, transport companies, consumer associations*

Objective B1: Energy Efficiency Campaigns
Action B1.1: Establishing information points in the municipality
Action B1.2: Organizing energy-saving activities throughout the city.

Action B1.1: Establishing municipal information points

While the structure of electricity consumption in Turkish homes varies greatly depending on the household, family's income level, and appliance infrastructure, according to data from the Turkish White Goods Manufacturers Association; 85% of the electricity used in homes is consumed by electrical and electronic appliances, and refrigerators have the highest share in household electricity consumption at 32%.

In our country, technologies developed in the last 10 years have resulted in improvements of up to 60% in the energy consumption of products. Today, Turkish manufacturers are in a position to produce the most energy-efficient products in terms of technology, capacity, and expertise. Our country's white goods manufacturers are the second largest producers in Europe and lead the EU's electrical household appliance market. The EU's "92/75/EEC Labelling and Standard Product Code for Energy and Other Resource Consumption of Electrical Household Appliances"

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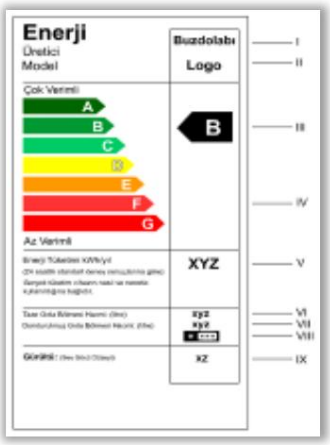
Compliance with the Council Directive of 22 September 1992 on the Display of Information via Internet Protocol and all related legislation has been ensured in our country.

In Türkiye, approximately 20% of the energy consumed in homes is used for lighting, although this varies according to income groups. It is possible to achieve savings of up to 80% by using energy-efficient light bulbs.

Compared to normal incandescent lamps, fluorescent lamps are 5-10 times more efficient, and compact fluorescent lamps are 4-5 times more efficient. When comparing the luminous flux of a standard incandescent lamp, a 100-watt lamp provides 14 lm/watt, while a compact fluorescent lamp provides 70 lm/watt. Incandescent lamps are very commonly used for lighting in our country. This is a poorly energy-efficient lighting method. Similarly, in offices and commercial buildings, lighting can account for 30-40% of electricity consumption.

Information centers will be established in Bursa province where residents and workers can obtain information on topics such as energy consumption, energy saving, new technologies, and application companies. These centers, which will be located in service buildings and/or other visible locations, will provide information to citizens and distribute brochures.



Consumer habits have a greater impact on energy saving than anticipated. Small changes in consumers' daily habits can have a greater-than-expected effect on energy consumption. For example, leaving electrical devices in standby mode accounts for 10-20% of total consumption. This means that a device left in standby for 10 hours consumes as much energy as, at best, one hour of operation.

The scenario is based on an estimate that changes in energy consumption habits will have an impact of up to 5% on energy consumption and greenhouse gas emissions.

Drawing on experiences from other cities that already provide similar services to large audiences, the information provided should expand beyond renewable energy technologies to include topics such as energy-efficient lighting, energy-efficient electronic devices, insulation, and the use of public transportation, ensuring that citizens benefit from these information points. Cooperation with district municipalities is possible in this regard.

The consultants who will work at the information points need to have their job descriptions defined and be trained. Establishing a structure to which the consultants will report and creating an implementation plan are necessary for all activities to be carried out in a coordinated manner. Consultants;

- We should help those in need find the best technology in terms of energy and environmental performance and adapt it to the characteristics of their homes or the buildings where they will implement the technology. should.
- Support should be obtained from chambers and associations working on this issue in Bursa, and joint action should be taken if possible. should be done.
- They should provide information on suitable financial incentives.
- When necessary, regarding legal procedures related to the installation of energy technologies should help.
- It should assist in selecting efficient heating and cooling systems in terms of air quality and energy efficiency.

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Action B1.2: Organizing energy-saving activities throughout the city.

The aim is to increase awareness of energy saving at the point of consumption and to encourage the purchase of energy-efficient electrical appliances. Bursa Metropolitan Municipality can organize various campaigns to instill energy saving awareness. The second week of January is "Energy Efficiency Week" throughout Türkiye. Especially during this period, fairs and stands set up in various areas (shopping malls) should be organized to raise awareness on the subject.

Leading electrical appliance manufacturers, insulation companies/associations, and lighting equipment manufacturers can organize joint campaigns (discount campaigns, low-interest loan campaigns, etc.) to support the awareness campaign.

Many fairs are held in Bursa throughout the year. Setting up stands at these fairs could potentially reach a large number of people.

It is known that a significant portion of the electricity consumed in homes comes from the use of appliances classified as white goods, such as refrigerators, washing machines, dishwashers, and air conditioners.

In homes that are also high energy consumers, replacing electronic devices with those in high energy efficiency classes (A, A+, A++) can result in energy savings of between 40% and 70%.

4.2 ACTION PLAN SUMMARY

Figure 4.16 below shows the development of Bursa's greenhouse gas emissions in 2030 and the planned reduction scenarios. In the graph, the vertical axis on the left shows total greenhouse gas emissions (kton), the vertical axis on the right shows per capita greenhouse gas emissions (person/ton CO_2e) , and the horizontal axis shows emissions over time (years). As explained in detail in previous sections, the base (reference) year city inventory for 2014 is 12,825 kton CO_2e , and the greenhouse gas inventory for 2030, calculated using the baseline (reference) approach, is 18,052 kton CO_2e . The graph shows the following emission reduction scenarios in order: Current Situation and Developments (CSD), Energy Efficiency in Buildings (including buildings and industrial facilities) (BEE), Energy Efficiency in Transportation (EET), Other Emission Reductions (EEA), Energy Production Efficiency (EPE), and Renewable Energy (RE). The mitigation scenarios result in total greenhouse gas emissions decreasing to 12,452 ktons of CO_2e. If no measures are taken (according to the BAU or "as is, so is it" scenario), per capita emissions would increase from 4.61 tons of CO_2e in 2014 to 5.37 tons of CO_2e in 2030 ; however, when per capita emissions are calculated based on the mitigation scenarios (SCENARIO), they are projected to fall to 3.70 tons of CO_2e in 2030. Compared to the reference year 2014, a 20% reduction in per capita emissions is targeted.

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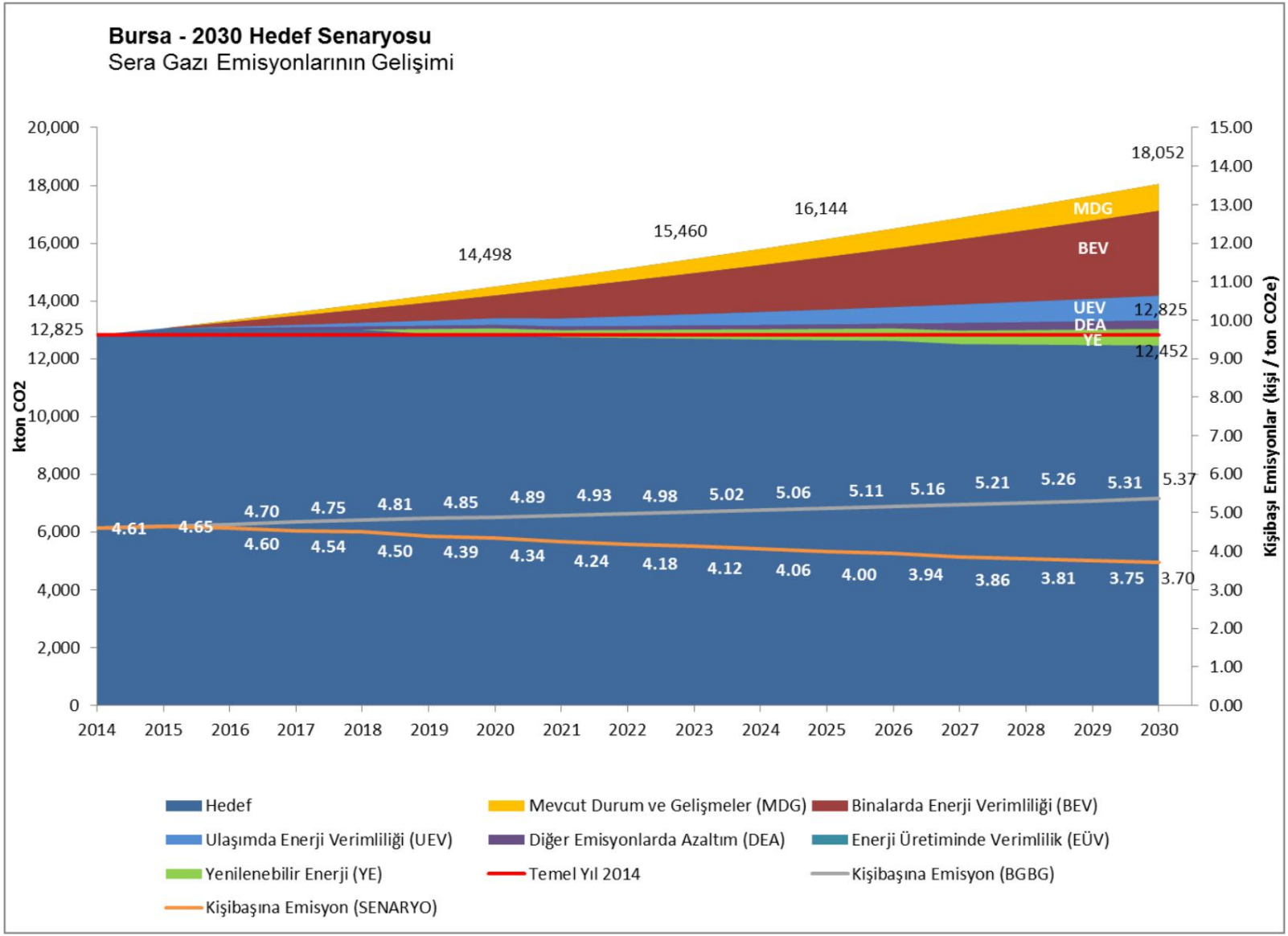

FIGURE 4-16: BURSA 2030 GREENHOUSE GAS EMISSIONS TARGET SCENARIO.

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URBAN DEVELOPMENT - THE BUILT ENVIRONMENT				
Objective B1: Energy-efficient renovations in existing	**Time Plan**	**Relevant Institutions**	**Energy Consumption Reduction (MWh)**	**CO2e Reduction (tons) by 2030**
homes. Action B1.1: Thermal insulation in	2016 - 2030	Homeowners, BBB, ÇÿB, ETKB, ÿZODER, ENVERDER, Contractors, Financial Institutions, City Region Planning, Chamber of Architects, implementation firms, insulation material, lighting and PV manufacturers.	1.881.493	698.517
existing homes. Action B1.2: Applications of renewable energy in	2016-2030			
existing homes. Action B1.3: Use of energy-efficient lighting systems (energy-saving LED) in existing homes.	2017 - 2030		163.426	80.830
Action B1.4 Heating approximately 100,000 homes with district heating.	2020 - 2030		409.747	82.974
Objective B2: Energy-efficient planning of new residential areas.	**Time Plan**	**Relevant Institutions**	**Energy Consumption Reduction (MWh)**	**CO2e Reduction (tons) by 2030**
Action B2.1: Urban transformation in housing.	2021 - 2030	Homeowners, insulation material manufacturers, installation companies, IZODER, ENVERDER, professional organizations, financial institutions, ETKB	513.379	131.943
Action B2.2: Sustainable design practices in new residential areas/new construction areas.	2021 - 2030			
Objective B3: Energy-efficient renovations in existing commercial buildings (including public buildings)	**Time Plan**	**Relevant Institutions**	**Energy Consumption Reduction (MWh)**	**CO2e Reduction (tons) by 2030**
Action B3.1: Energy-efficient renovations (thermal insulation) in existing commercial buildings	2016 - 2030	Commercial and public building users, BTSO, Ministry of Energy and Natural Resources, Governorship, Provincial Special Administration, insulation material manufacturers, application companies, financial institutions	298.621	119.704
Action B3.2: Energy-efficient lighting in existing commercial	2016 - 2030		174.014	86.067
buildings. Objective B4: Energy-efficient practices in municipal buildings.	**Time Plan**	**Relevant Institutions**	**Energy Consumption Reduction (MWh)**	**CO2e Reduction (tons) by 2030**
Action B4.1: Energy-efficient renovations (thermal insulation + lighting) in existing municipal buildings	2016 - 2030	BBB, District Municipalities, ENVERDER, ÿZODER, ETKB, financial institutions, various funds, development agencies	81.433	37.146
Objective B5: Energy-efficient street lighting systems.	**Time Plan**	**Relevant Institutions**	**Energy Consumption Reduction (MWh)**	**CO2e Reduction (tons) by 2030**
Action B5.1: Energy-efficient street lighting system	2016-2020	ABB, district municipalities, provincial special administration, energy-efficient lighting manufacturers, financial institutions, Ministry of Energy and Natural Resources, various funds, development agencies	172.920	85.526
Action B5.2: PV integration into street lighting systems	2016-2020		11.067	5.474
TOTAL			**3.706.100**	**1.328.181**

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TRANSPORT				
Objective U1: Public transport	**Time Plan**	**Relevant Institutions**	**Energy Consumption Reduction (MWh)**	**CO2e Reduction (tons) by 2030**
Action U1.1: Increasing the rate of public transport use	2016 - 2030	BBB, BURULAÿ, Transportation Ministry, financial institutions	619.014	161.405
Action U1.2: Connecting Bursa to the high-speed rail network.	2020 - 2030		86.879	35.171
Objective U2: Pedestrian and bicycle use and integration into public	**Time Plan**	**Relevant Institutions**	**Energy Consumption Reduction (MWh)**	**CO2e Reduction (tons) by 2030**
transport. **Action U2.1: Increasing bicycle use from the current <0.5% to 2.5%.**	2016-2030	BBB, Highways Directorate, citizens, universities, schools, Ministry of National Education, commercial entities. buildings	130.319	33.980
Action U2.2: Increasing pedestrian use from the current 42% to 47%.	2016-2030		325.797	84.950
Objective U3: Use of alternative technologies and fuels.	**Time Plan**	**Relevant Institutions**	**Energy Consumption Reduction (MWh)**	**CO2e Reduction (tons) by 2030**
Action U3.1 Replacing public transport vehicles with energy-efficient vehicles.	2016-2030	BBB, Ministry of Transport, Buulaÿ, citizens,	304.125	82.606
Action U3.2 Setting an example by replacing 80% of the municipal vehicle fleet with electric vehicles to encourage the use of electric vehicles.	2016 -2030		22.451	6.093
Objective U4: Traffic optimization arrangements	**Time Plan**	**Relevant Institutions**	**Energy Consumption Reduction (MWh)**	**CO2e Reduction (tons) by 2030**
Action U4.1: Low-investment traffic optimization measures	2016-2030	BBB, Citizens	558.930	203.880
Goal U5: Reducing emissions from logistics and transportation fleets.	**Time Plan**	**Relevant Institutions**	**Energy Consumption Reduction (MWh)**	**CO2e Reduction (tons) by 2030**
Goal U5: Reducing emissions from logistics and transportation fleets.	2016-2030	Industrial companies, logistics firms, BBB, BTSO	691.298	187.770

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Objective U6: Training in economical driving techniques (especially for drivers operating taxis, public transport, and waste collection vehicles)	Time Plan	Relevant Institutions	Energy Consumption Reduction (MWh)	CO2e Reduction (tons) by 2030
Objective U6: Training in economical driving techniques (especially for drivers operating taxis, public transport, and waste collection vehicles)	2016-2030	Industrial companies, logistics firms, BBB, BTSO	230.433	62.590
TOTAL			2.969.246	858.445

RENEWABLE ENERGY

Objective YE1: Renewable energy applications Action	Time Plan	Relevant Institutions	Energy Consumption Reduction (MWh)	CO2e Reduction (tons) by 2030
YE1.1: Renewable energy applications in Organized Industrial	2016 - 2030	Ministry of Energy and Natural Resources, General Directorate of Forestry, Organized Industrial Zone administrations, industrial organizations, farmers, large-scale commercial organizations, Ministry of Forestry, Renewable Energy Investors, financial institutions, BBB and its affiliates	250.000	123.649
Zones Action YE1.2: Renewable energy applications in municipalities	2016 - 2030		25.000	12.365
and their subsidiaries Action YE1.3: Installation of solar energy systems in agricultural irrigation	2016 - 2030		6.500	3.215
Action YE1.4: PV applications on building roofs Action	2019 - 2030		30.000	14.838
YE1.5: Solar energy applications on the roofs of new Organized Industrial Zones	2016 - 2030		688.708	340.633
Goal YE2: Energy generation from animal and agricultural waste	Time Plan	Relevant Institutions	Energy Consumption Reduction (MWh)	CO2e Reduction (tons) by 2030
Action YE2.1: Energy production from animal and agricultural waste.	2017 - 2030	Farmers, investors, financial institutions,	383.200	77.598
Objective YE3: Energy generation from wastewater sludge.	Time Plan	Relevant Institutions	Energy Consumption Reduction (MWh)	CO2e Reduction (tons) by 2030
Action YE3.1: Energy generation from wastewater	2017 - 2030	BUSKI	22.205	3.195
sludge TOTAL			1.405.613	575.493

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SOLID WASTE AND WASTEWATER MANAGEMENT				
Objective AA1: Solid Waste Landfills Action	Time Plan	Relevant Institutions	Energy Consumption Reduction (MWh)	CO2e Reduction in 230 Years (tons)
AA1.1: Extraction of LFG from All Solid Waste Landfills and Energy	2027 - 2030	BBB, District Municipalities, financial institutions, companies that produce energy from landfill gas.		99.141
Production Objective AA2: Separation of Solid Waste at Source	Time Plan		Energy Consumption Reduction (MWh)	CO2e Reduction in 230 Years (tons)
Action AA2.1. Reducing greenhouse gas emissions by separating solid waste at source.	2016 - 2030			
Objective AA3: Wastewater treatment	Time Plan	Relevant Institutions	Energy Consumption Reduction (MWh)	CO2e Reduction in 230 Years (tons)
plants. Action AA3.1: Improving operating conditions of all wastewater treatment	2017 - 2030	BBB, BUSKÿ, District Municipalities		87.828
plants. TOTAL			0	186.969

INDUSTRIAL SECTOR				
Objective S1: Energy Efficient Systems	Time Plan	Relevant Institutions	Energy Consumption Reduction (MWh)	CO2e Reduction (tons) by 2030
Action S1.1: Reducing energy consumption in industry through the use of energy-efficient systems.	2016 - 2030	BBB, Organized Industrial Zones, industrial establishments, financial institutions	3.733.275	1.473.191
TOTAL			3.733.275	1.473.191

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AGRICULTURE, LIVESTOCK, FORESTRY				
Objective THO1: To reduce chemical fertilizer consumption.	Time Plan	Relevant Institutions	Energy Consumption Reduction (MWh)	CO2e Reduction (tons) by 2030
Action THO1.1: Reducing the Use of Chemical Fertilizers	2016 - 2030	BBB, Provincial Directorate of Agriculture and Livestock Directorate, farmers		63.800
The goal of THO2: To reduce animal waste.	Time Plan		Energy Consumption Reduction (MWh)	CO2e Reduction (tons) by 2030
Action B1.2: Reducing animal waste.	2018 - 2030			39.838
THO3: Reducing energy consumption in vehicles. reduction	Time Plan		Energy Consumption Reduction (MWh)	CO2e Reduction (tons) by 2030
Action THO3.1: Reducing energy consumption in vehicles through land consolidation	2016 - 2030			
TOTAL				103.638

AWARENESS CAMPAIGNS

Objective B1: Energy Efficiency Campaigns Action	Time Plan	Relevant Institutions	Energy Consumption Reduction (MWh)	CO2e Reduction (tons) by 2030
B1.1: Establishing information points in the municipality Action B1.2:	2016-2030	BBB, district municipalities, citizens, implementation companies, electronic device manufacturers, financial institutions, consumer associations	255.455	81.993
Organizing energy saving events throughout the city	2016-2030		148.360	55.663
TOTAL			403.815	137.656

TOTAL	14.834.483	5.596.488

*The total reduction figure includes the expected natural energy consumption (2.6 million kWh) and greenhouse gas emissions (0.9 million tons CO2e) that will be achieved through energy efficiency and technological advancements .

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4.3 ACTION PLAN EVALUATION

The Bursa Climate Change Action Plan outlines a roadmap for reducing emissions from energy consumption in various sectors, determined through the participation of urban stakeholders. The plan is based on a city-wide greenhouse gas inventory and is supported by the future visions of urban stakeholders and reports prepared and commissioned by the Metropolitan Municipality and other institutions regarding the city's future.

The Bursa urban greenhouse gas emissions inventory **determined** Bursa's total carbon footprint to be approximately **12,825,146 tons of CO2e** for the year 2014, which was chosen as the reference year. It appears that approximately **216,970** tons of this originated directly from the municipality's institutional activities (1.70%). 44% of Bursa's total carbon footprint emissions come from fuels used in residential, commercial buildings and industrial facilities, as well as urban vehicle traffic (Scope 1 category), 37% from electricity consumption (Scope 2 category), and 19% from other emissions such as industrial processes and energy production facilities, solid waste and wastewater, and agriculture and livestock farming.

In Bursa, industrial fuel and electricity consumption accounts for the largest share (32%) of the city-wide emissions inventory. This is followed by residential fuel and electricity consumption (20% of the total) and urban transportation (19%). Greenhouse gas emissions from energy consumption in non-residential buildings account for 10%. The total emissions are around 1.5%, while enteric fermentation and manure management from livestock farming account for nearly 6%. Industrial process emissions from the cement plant and energy production facilities in the city constitute 11% of total city emissions.

The fact that the industrial sector accounts for the largest share, and the current number of organized industrial zones in Bursa, as well as the projections of various institutions regarding the potential growth rates of this sector, constitute the weakest point of any mitigation strategy that the local government might implement. This is because local governments lack the authority to regulate energy efficiency and the use of non-greenhouse gas renewable energy sources in this sector. However, the local government does have the capacity to make regulations regarding the environmental and technological characteristics of the economic activities it plans to prioritize in Bursa through various interventions within its jurisdiction. Furthermore, land and spatial use decisions can also provide some guidance on the direction of this development.

BÿDEP has developed Bursa's BAU (Business as Usual) scenario using projections from various institutions regarding population and sectoral growth, and has calculated 2030 emissions to be approximately 18 million tons of CO2e . Similar to the reference year, the largest component of 2030 emissions will again be industrial emissions at 35%. Residential and non-residential buildings follow at 30%, and transportation at 22%.

Turkey's urban growth rates, in terms of quality and quantity, resemble those of developing countries rather than developed/industrialized countries. Since it is not reasonable to speak of absolute emission reductions at these growth rates, it is more accurate to express emission reduction targets as per capita emissions. According to the BAU scenario, per capita emissions increase from 4.61 tons of CO2e to 5.37 tons (a 16% increase).

BÿDEP demonstrates that, through the mitigation measures implemented in every sector, Bursa can achieve almost "zero" emission growth until 2030, and that per capita emissions can be reduced by approximately 20% in 2030 compared to 2014.

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The graphs below show Bursa's total emissions in 2014 (the reference year), emissions projected for 2030 under the BAU (continuous as is) scenario, and emission reductions achievable by 2030 according to various measures proposed in the prepared Climate Change Action Plan for different source sectors.

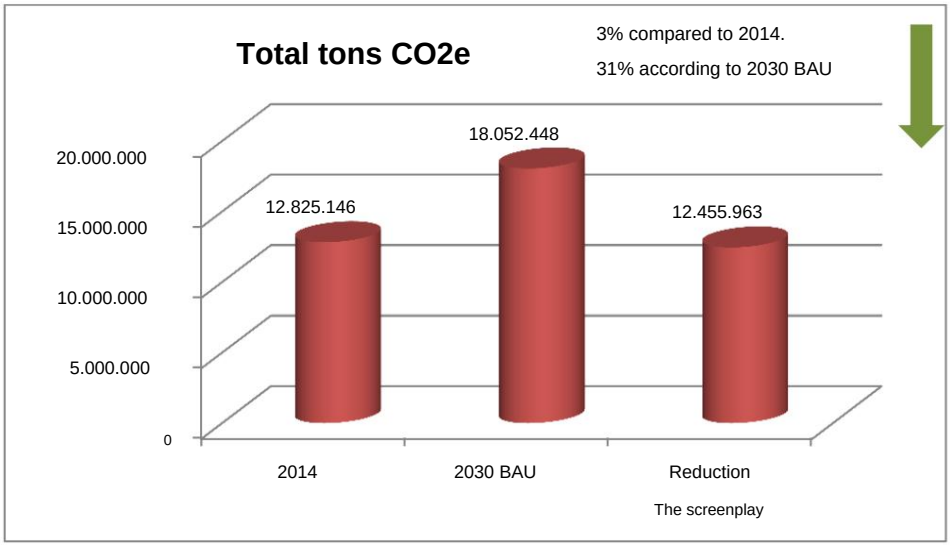

FIGURE 4-17: TOTAL GREENHOUSE GAS EMISSIONS OF BURSA IN 2014, 2030 BAU AND REDUCTION SCENARIO. COMPARISON

As can be seen from the figure, due to high population growth and high growth rates in the industrial sector, absolute emissions cannot be significantly reduced compared to the base year of 2014, even if all the proposed measures are implemented. It has been calculated that potential emissions in 2030 could be reduced by approximately 5.6 million tons of CO2e as a result of energy efficiency measures in various sectors and investments in renewable energy . Per capita greenhouse gas emissions can be significantly reduced with the same reduction scenario, achieving a decrease of approximately 31% according to the BAU scenario and nearly 20% compared to the reference year 2014. This can be seen in the figure below.

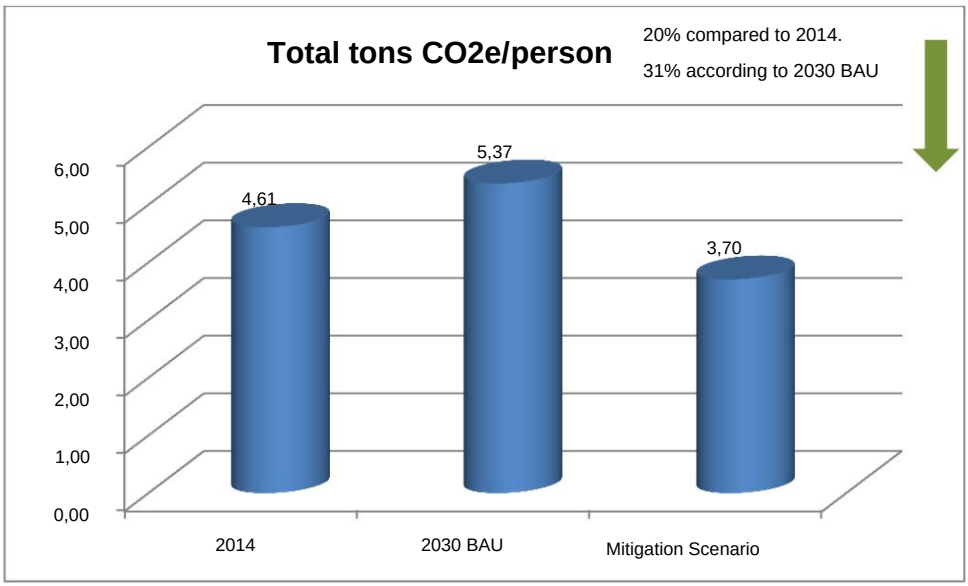

FIGURE 4-18: PER CAPITA GREENHOUSE GAS EMISSIONS IN BURSA, 2014, 2030 BAU AND REDUCTION SCENARIO. COMPARISON

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In contrast, the mitigation scenario suggests that Bursa will **experience zero-emission growth** despite high growth rates. This also shows that it can be achieved, which should be considered a significant success.

When the BAU and Mitigation Scenarios are examined on a sectoral basis, the following results are obtained.
As previously mentioned, the most significant component of Bursa's emissions is industrial emissions. The city's industrial growth, projected to exceed its population ratio, is the strongest obstacle to low-carbon urban growth. The figures below show industrial sector emissions in absolute and per capita terms. It is estimated that various measures could reduce industrial emissions by approximately 1.5 million tons of CO2e by 2030 (renewable energy investments are not included in this figure).

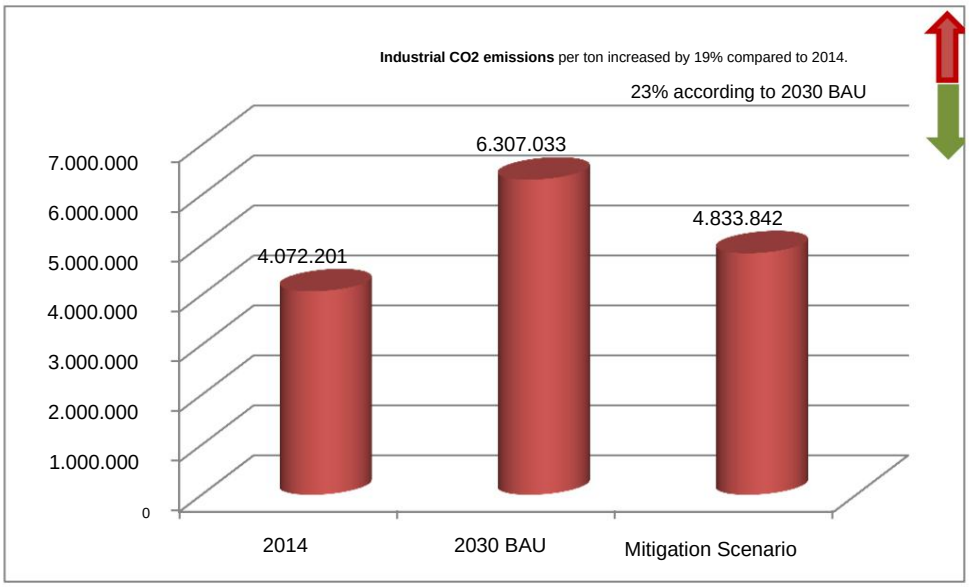

FIGURE 4-19: COMPARISON OF BURSA INDUSTRIAL EMISSIONS IN 2014, WITH 2030 BAU AND REDUCTION SCENARIOS.

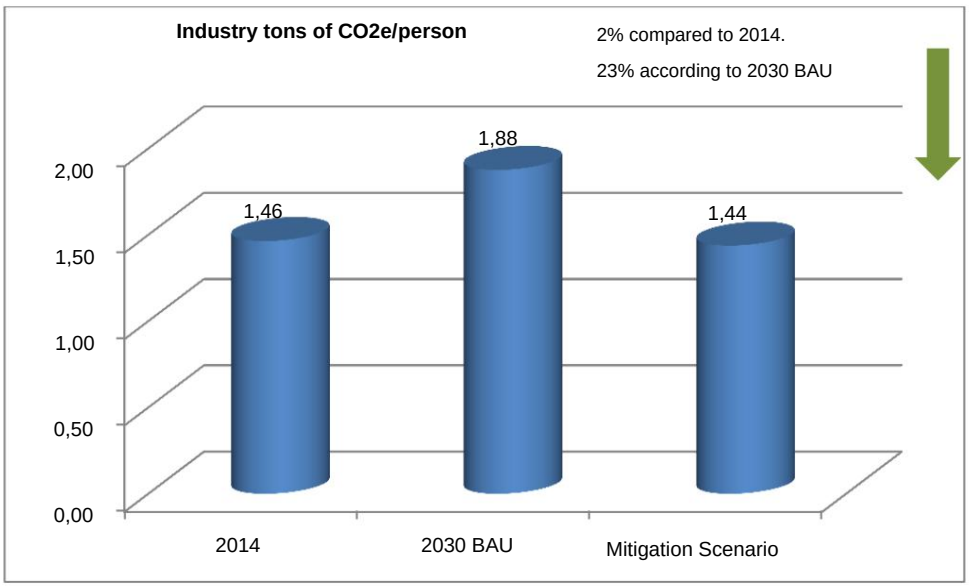

FIGURE 4-20: PER CAPITA GREENHOUSE GAS EMISSIONS OF BURSA INDUSTRIAL SECTOR, 2014, 2030. MITIGATING SCENARIO COMPARISON

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Despite all the measures taken, industrial emissions, projected to grow by almost 40%, cannot be prevented from increasing by 19% in absolute terms. A meager 2% decrease in per capita emissions is calculated for the sector. The energy and carbon intensity of the industrial sector should primarily be controlled through national regulations. Much higher rates of renewable energy supply (for example, in current mitigation scenarios, only a realistic 20% rate is considered for new industrial zones) are seen as the only way to significantly reduce industrial emissions.

Providing incentives for high rates of zero-emission renewable energy technologies for the self-consumption of existing and new Organized Industrial Zones (OIZs), and making the use of cogeneration and waste heat mandatory, would be appropriate. It would also be beneficial for local governments, when carrying out land use and spatial planning, to consider environmental factors and encourage the long-term shift of the city's growing industrial sector towards high-technology sectors with low energy and carbon intensity.

Building stock energy and carbon intensities are the second largest source of emissions in Bursa's urban inventory.
With a growing population and changing consumption habits, it is essential to encourage low-carbon routes in terms of both building characteristics and consumption habits, to increase energy efficiency in the existing building stock, and to construct new buildings that require significantly less energy. The following two figures...
This data shows building emissions and reduction scenarios in Bursa in terms of absolute and per capita values. It is predicted that building emissions can be reduced by approximately 1.5 million tons of CO2e by 2030 through various measures (this figure includes awareness campaigns but does not include reductions resulting from renewable energy investments).

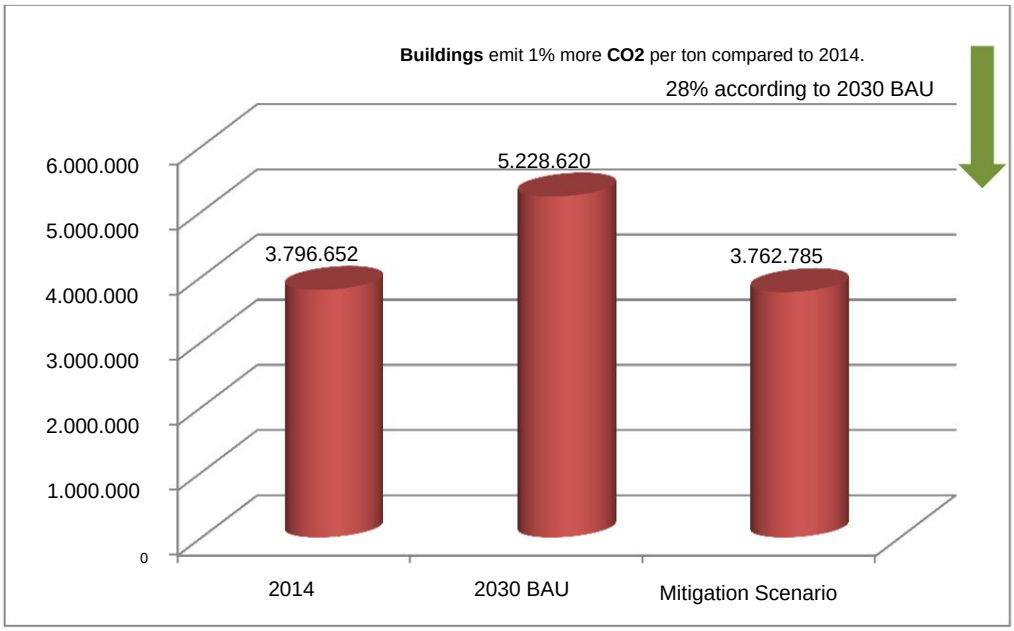

FIGURE 4-21: EMISSIONS FROM BUILDINGS IN BURSA, 2014, 2030 BAU AND REDUCTION PROJECTS. SCENARIO COMPARISON

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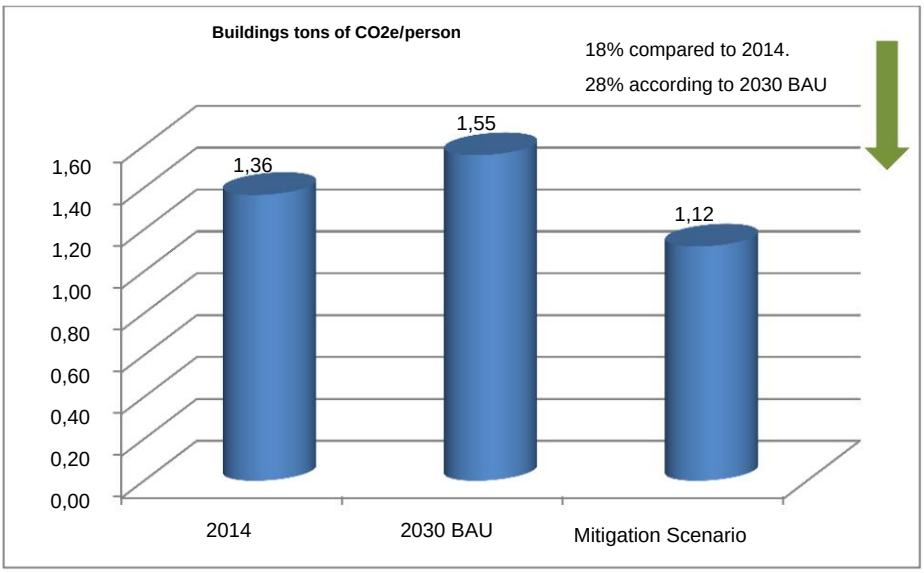

FIGURE 4-22: PER CAPITA GREENHOUSE GAS EMISSIONS FROM BUILDINGS IN BURSA, 2014, 2030 BAU AND REDUCTION PROJECTS. SCENARIO COMPARISON

While high population growth rates make it difficult to achieve a significant reduction in absolute emissions, it has been shown that per capita emissions can be reduced by 28% compared to the reference year through mitigation measures. It has also been demonstrated that local governments can be effective in promoting energy efficiency and renewable energy applications in both existing and newly constructed buildings through permitting and licensing processes and planning guidelines.

Transportation, as the third most important source of emissions, is likely the sector that local governments can control the most. The source of emissions is fossil fuel-powered vehicles and their high share in urban transportation. The figures below summarize transportation emissions in terms of reference year, BAU (Balance of Activity), and reduction scenarios. It is projected that with various measures, transportation emissions can be reduced by approximately 0.9 million tons of CO2e by 2030 .

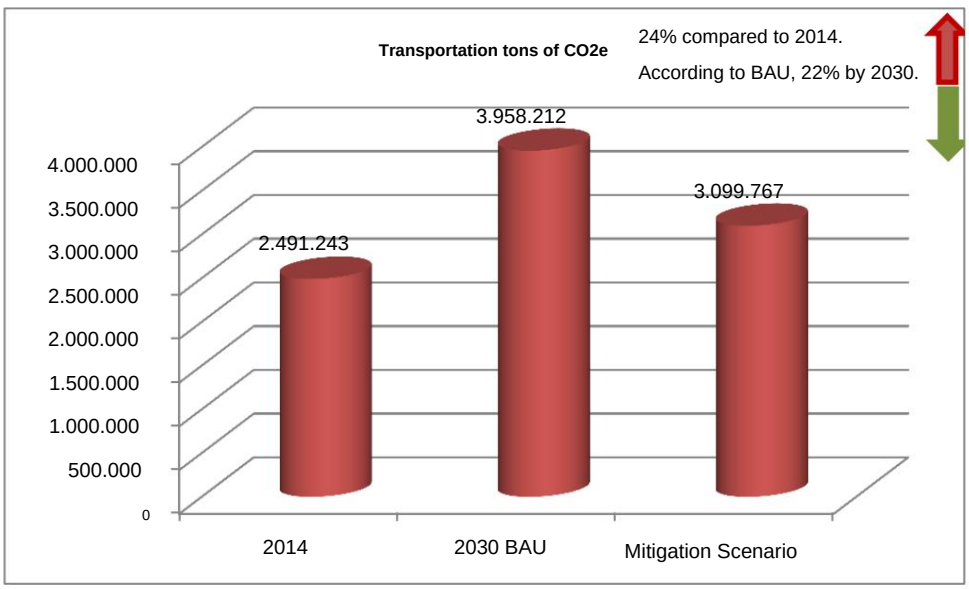

FIGURE 4-23: EMISSIONS FROM TRANSPORTATION IN BURSA, 2014, 2030 BAU AND REDUCTION PROJECTS. SCENARIO COMPARISON

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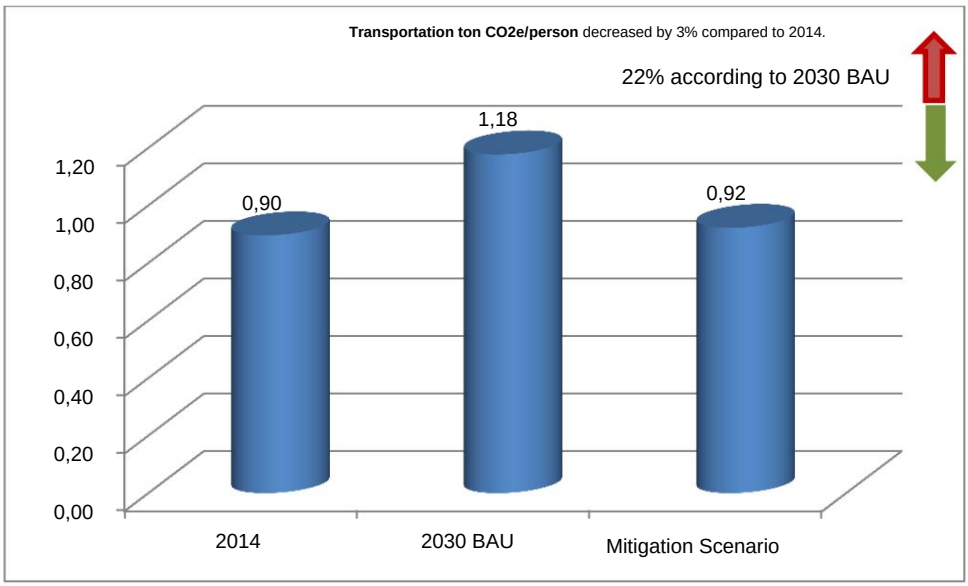

FIGURE 4-24: BURSA TRANSPORTATION PER CAPITA GREENHOUSE GAS EMISSIONS 2014, 2030 BAU AND REDUCTION PROJECTS. SCENARIO COMPARISON

Despite implemented mitigation measures, transportation emissions in Bursa are increasing by approximately 24% in parallel with the city's growth. Even per capita emissions have only increased slightly compared to the reference year, despite these mitigation measures. The measures and policies that the local government can implement to reduce emissions in this sector are outlined in the Bursa Transportation Master Plan. Expanding urban rail transport and public transportation in general to much higher rates, and rapidly developing pedestrian and bicycle-friendly infrastructure, will not only reduce energy and carbon intensity in transportation but also decrease air pollution and improve the city's livability.

In the "Other" category of emission sources, such as waste and water management, process-based emissions, and forest and agricultural greenhouse gas emissions, significant reductions appear possible, even if their impact on the total inventory is low. The figures below summarize the "Other" category emissions and scenarios.
It is estimated that with various measures, these emissions could be reduced by approximately 0.3 million tons of CO2e by 2030 .

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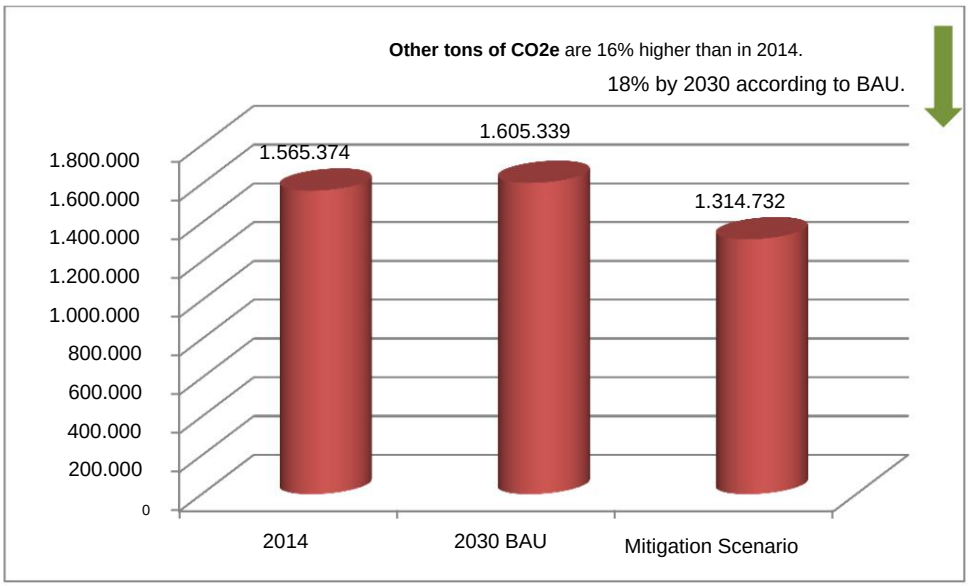

FIGURE 4-25: COMPARISON OF BURSA OTHER EMISSIONS IN 2014, 2030 BAU AND REDUCTION SCENARIOS.

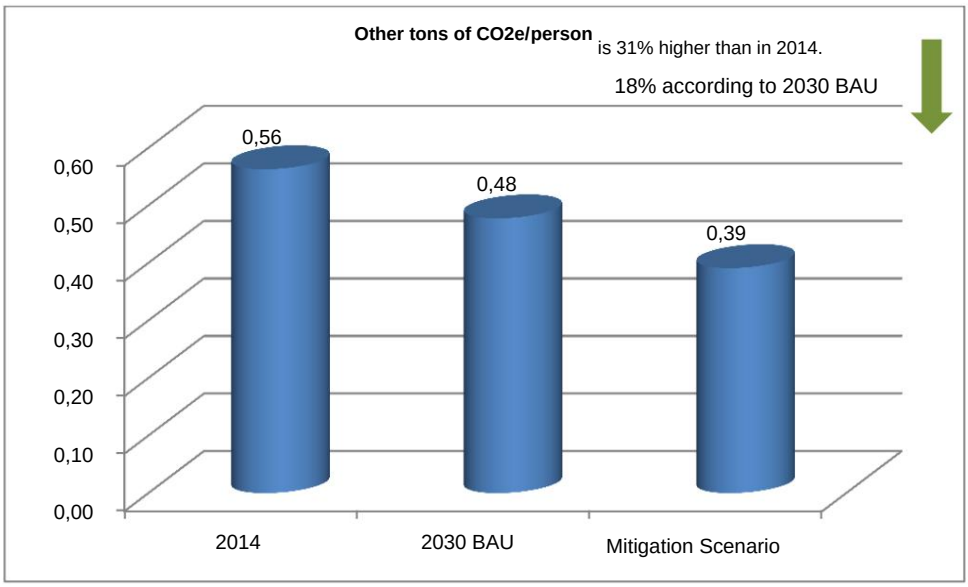

FIGURE 4-26: BURSA OTHER PER CAPITA GREENHOUSE GAS EMISSIONS 2014, 2030 BAU AND REDUCTION. SCENARIO COMPARISON

It would be appropriate to highlight the potential impact of process emissions within this category.

The potential contribution of different sectors to the growth of Bursa's industry could significantly impact the city's future inventory. For example, the increasing presence of sectors with high energy and carbon intensity, such as cement, iron and steel (if integrated), and glass, not only due to high energy demands but also the contribution of their production processes, will create a serious weakness in emission reduction. The high-level use of renewable energy in the agricultural sector is a practice that should be encouraged due to its high technical and economic feasibility. Increasingly including urban forest resources as carbon sinks in reduction scenarios and the acceptance of these measures in international protocols could be advantageous for a city like Bursa, which has a high amount of forest cover.

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When all these measures are combined with the 0.6 million tonne CO2e reduction that can be achieved through renewable energy applications in buildings, industry and biofuel potential, agricultural irrigation and wastewater treatment plants, and the 7% natural energy gain by 2030 in light of the projections of official government institutions and developments in energy efficiency in Turkey's recent history, it shows that 5.6 million tonnes of CO2e can be saved from the 18 million tonnes of CO2e greenhouse gas emissions that will be reached in 2030 if no measures were taken .

TABLE 4-14: REDUCTION MEASURES AND SAVINGS AMOUNTS

MITIGATION MEASURES HEADLINES	Energy Saving (MWh)	tCO2e Reduction
Urban Development - Built Environment	3.706.100	1.328.181
Transport	2.969.246	858.445
Renewable Energy	1.405.613	575.493
Solid Waste and Wastewater Management		186.969
Industry and Services	3.733.275	1.473.191
Agriculture, Livestock, Forestry		103.638
Awareness Campaigns	403.815	137.656
Natural energy efficiency	2.616.434	932.915
TOTAL*	**14.834.483**	**5.596.488**

*National policies and technological advancements aimed at energy efficiency are expected to result in a 7% "natural" reduction in emissions.

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5. CLIMATE CHANGE ADAPTATION EFFORTS

The 1/100,000 Environmental Planning Map, prepared by experts for Bursa Metropolitan Municipality in 2013, includes a Climate, Air Quality and Pollution Report among the Natural Structure Sector Reports. The report begins with the paragraph quoted below;

> *"...According to initial findings, rapid, unplanned urbanization and industrialization have caused an increase of approximately 0.5 °C in temperature measurements over the last 20 years in Bursa's local climate. Furthermore, the decrease in green spaces since the 1990s, excessive concrete construction, and the creation of new residential areas due to high population density have led to a 25% increase in average solar radiation intensity. The most pessimistic climate..."*
> *According to projections, average temperatures in Bursa and its surroundings are expected to increase significantly, especially after 2040-50. The average temperature between 2071-2099 is projected to be 3-4°C higher than the average between 1960-1990, while total annual rainfall is expected to decrease by 10-15%. Rainfall, which has been fluctuating around the average until the 2050s, is predicted to enter a serious downward trend after the second half of this century. These expectations regarding temperature and rainfall, coupled with increasing urbanization in Bursa and its surroundings, could create significant problems and raise alarm signals regarding water resources.*
>
> *It has been determined that air pollution levels in the city center of Bursa are extremely high, and the number of days exceeding limit values has reached levels that threaten human health.*
> *Bursa is a polluted city according to international standards for air quality. Bursa is negatively affected both by its own emissions and by the dense industrial and residential areas surrounding it..."*

It is known that Türkiye, especially the Mediterranean, Aegean, and Marmara Regions, will be among the areas most affected by the negative impacts of climate change in the Eastern Mediterranean. Studies conducted by the ITU Eurasian Institute of Earth Sciences, supported by UNDP, TÜBÿTAK, and DPT, reveal striking results. As can be seen from the summary above, the Bursa outputs of their modeling show an average annual increase of 3-4 million years.

"It shows temperature increases of C and average rainfall decreases of 10-15%.

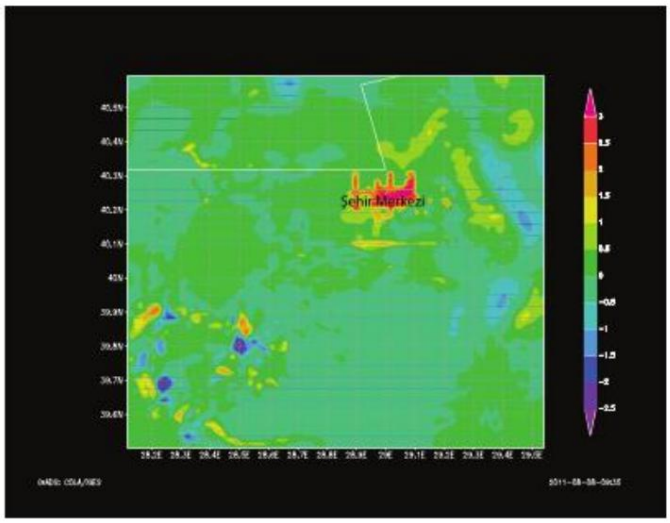

FIGURE 5-1: URBAN HEAT ISLAND MEASUREMENTS IN BURSA16

16. *Bursa 2030 1/100,000 Environmental Planning Climate Report, Bursa Metropolitan Municipality 2012*

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As shown in the figure, the average daytime temperature in the center of Bursa is up to 30 °C higher than its surroundings. It is stated that the city's growth, increased traffic, and loss of urban green spaces will exacerbate this effect. The figure below summarizes the results of the climate change modeling conducted by the ITU Eurasian Institute of Earth Sciences in terms of temperatures. According to the report, the most dramatic effects will be seen from the 2030s onwards.

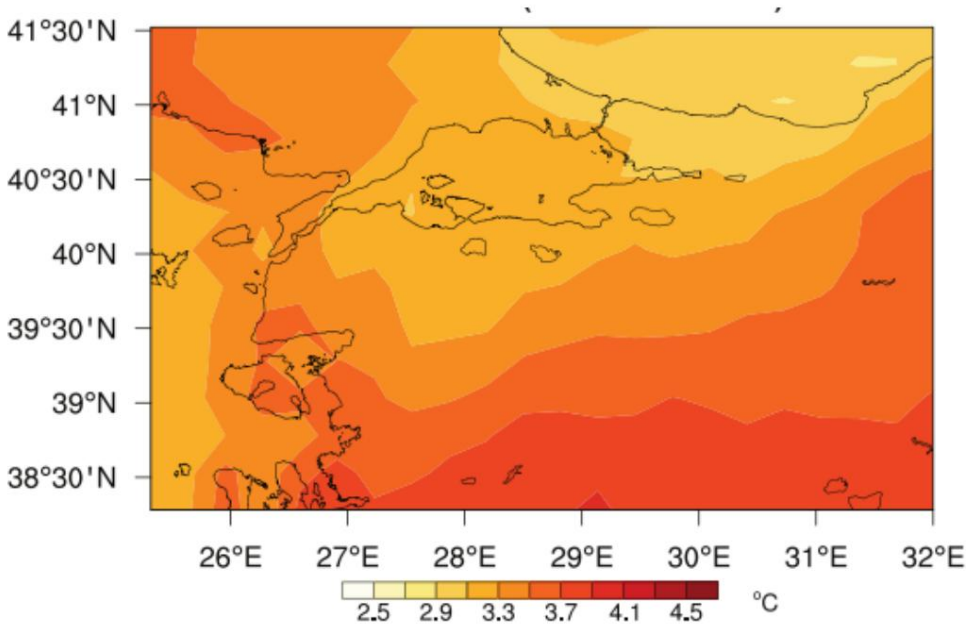

FIGURE 5-2: ITU EURASIA INSTITUTE OF EARTH SCIENCES CLIMATE CHANGE MODELING

Pessimistic scenarios indicate that average temperatures in Bursa will increase by 3-4°C .

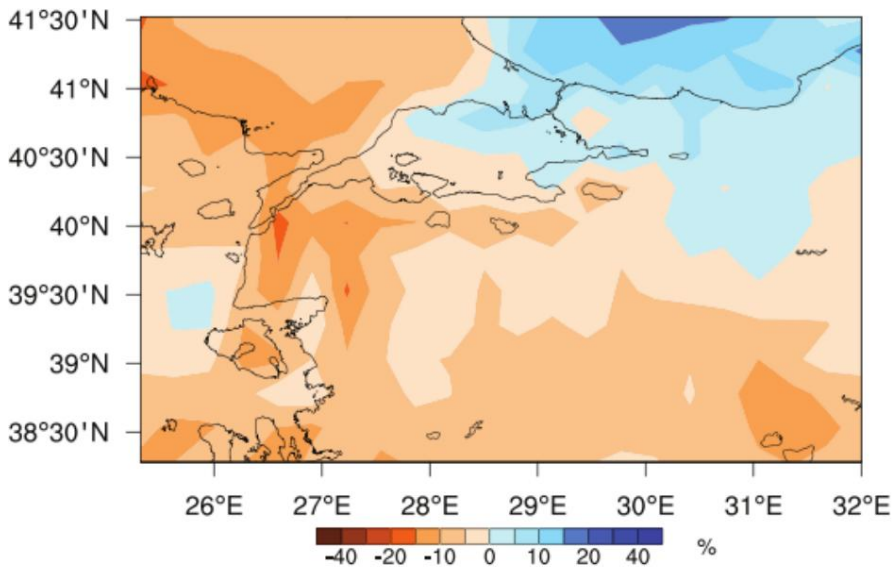

FIGURE 5-3: MODELING OF PRECIPITATION AND THE EFFECTS OF CLIMATE CHANGE FOR BURSA.

As can be seen from the figure above, a 10-15% decrease in average rainfall is expected.
Türkiye's First National Communication submitted to the United Nations summarizes the economic, social, and societal impacts of these changes as shown in the table below.

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TABLE 5-1: POTENTIAL ECONOMIC, SOCIAL, AND SOCIETAL IMPACTS OF CLIMATE CHANGE

Effects	Violence	Affected Areas	Affected Sectors/Themes
Changes in river/basin regimes	Low	All regions	Ecosystem services and biodiversity
Decreasing surface waters	Medium	Western Anatolia Region	Agriculture, water distribution network infrastructure.
Increasing water scarcity	High	Istanbul, Ankara, Aydÿn, Nevsehir, Bursa	urban areas
	Medium	Afyonkarahisar, Kayseri, ÿzmir, Muÿla, Manisa,	Agriculture, industry, energy
Cell	Medium	Black Sea and Southeastern Anatolia Anatolian Regions	The survival of agricultural farmers depends on human health.
Soil erosion/salinity	Low	Mediterranean, Black Sea, Aegean and Southeastern Anatolia Regions	Tourism, ecosystem services, biodiversity, marine products
Land degradation, the loss of soil quality.	Medium	Southwestern Anatolia	The survival of agricultural farmers, food security, shallow lakes, wetlands.
Coastal erosion	Low	Black Sea Region	Fishing, unemployment.
marine ecosystem deterioration	Low	Mediterranean, Aegean, and Black Sea regions	Ecosystem services and biodiversity
Forest Fires	Medium	Western Anatolia	Tourism, agriculture
The migration of species to other areas to survive.	Low	Mediterranean Region	Tourism, agriculture, food security.
Decreasing agricultural productivity	Medium	Mediterranean and Aegean coasts	Agriculture (employment), food security.
Decreasing hydropower potential . Low.		Mediterranean Region	Energy, industry
Declining seafood production	Low	Mediterranean Region	Agriculture, food security, water distribution network.

All studies predict that agricultural production quantities and varieties, energy production, the tourism sector, and most importantly, public health will be seriously affected.

One of the most significant consequences of climate change is the increase in the number of extreme meteorological events (such as sudden and intense rainfall, extremely oppressive heat waves, and prolonged droughts). While it is not possible to see a serious signal in long-term averages, investigating potential increases in these extreme events is extremely important.

Modeling studies reveal the number of days with extremely high temperatures. Accordingly, a significant increase in the number of very hot days is expected for Bursa and its surroundings. Previously, the number of high-temperature days was around 10-15 (for the period 1961-1990); according to climate model results for the period 2040-2099, this could increase to 30-40 days. This can be interpreted as a harbinger of much hotter summers for Bursa. It has been scientifically proven that these high temperatures pose a life-threatening risk, especially for the elderly and those with underlying health conditions.

Although periods of 15-20 years may seem long, they can be considered medium-term periods in terms of infrastructure and energy investments, industrial production facilities, and changes in the building stock. In this respect, adaptation to climate change is actually a matter of today in terms of the long-term and sustainable development of the city. While the Climate Change Action Plan shows the city administration the most cost-effective development paths with high multiplier effects in terms of energy and carbon intensity, it also addresses the impact of climate change, especially on public health.

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These measures must be reinforced with continuously updated Adaptation Plans to minimize negative and destructive consequences.

5.1 ORGANIZATIONAL STRUCTURE RELATED TO CLIMATE CHANGE PREVENTION AND ADAPTATION

The proposed policies regarding climate change concern all social, economic, and administrative units of the city, thus requiring serious cooperation and coordination among institutions. Local governments, which have authority in many areas from transportation to urban planning and are closest to the citizens, must work together through their various departments. Throughout the report, the proposed mitigation measures and action plans in each area are not tasks that can be carried out by a single unit. In this context, it is inconceivable that the urban planning, transportation, and waste management units could work separately.

Similarly, the direct and legally mandated duty of the Municipality is not so much to implement energy efficiency and other greenhouse gas emission reduction measures, but rather to evaluate the technical, economic, social, and environmental impacts that will pave the way for the realization of such projects, to help remove obstacles, and to guide their understanding and the creation of positive effects after implementation. However, the comprehensive powers granted to metropolitan administrations by the Local Government Law No. 6360 have essentially opened the way for Municipalities to be effective in some new areas, primarily in intervening in local energy flows. The development of local renewable energy sources for urban energy consumption is among these areas.

Developing and implementing local government Action Plans, as well as ensuring cooperation and harmony between central government and other public institutions, are prominent tasks. In Türkiye, this necessitates an extraordinary division of labor not only among municipalities but also among other central/local public units. In the world, particularly in the EU, the creation of an independent Energy Management/Climate Change-like unit, supported at the highest level by local governments in combating and adapting to climate change, is a widely used administrative structure.

ADMINISTRATIVE STRUCTURE RELATED TO THE CLIMATE CHANGE ACTION PLAN

Measures and implementations related to Climate Change Action Plans involve issues requiring interdisciplinary coordinated work. As seen in the CCP's content, the number of stakeholders involved in mitigation measures is quite large. It does not seem very feasible for a single unit within the local government to take ownership of and implement the issue, because each mitigation measure has socio-economic and cultural dimensions in addition to its environmental and economic aspects.

In Türkiye, Environmental Protection and/or Waste Management Units have generally carried out the relevant work in the preparation processes of Environmental Action Plans (EAPs), and have also undertaken the coordination of inventory and strategy preparation studies. However, when it comes to the implementation of the actions, the areas of authority and expertise of other institutions are important. Many stakeholders need to be involved in the implementation processes, including other municipal units, other public institutions, organizations operating in the industrial and service sectors, manufacturers of technologies and materials related to mitigation measures, implementation companies, financial institutions, citizens, etc.

The unit undertaking such a task must possess leadership skills that enable it to take initiative, have high motivation and persuasion abilities, and can foresee and assess potential problems. Various units and institutions...

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There is a need to establish a supra-unit structure with the authority to coordinate and direct work with organizations and institutions.

Preparing a strategic plan like IDEP requires collaboration and coordination among various local government units. The most important of these units in local governments are listed below.

ÿ Environmental protection
ÿ Land use
ÿ Urban planning
ÿ Economic and social services
ÿ Buildings and infrastructure management
ÿ Mobility and transport
ÿ Budget and finance
ÿ Purchasing

The responsibilities of the unit, which has the authority and capacity to ensure that all these institutions work in coordination when necessary, can be listed as follows.

- Updating inventory and IDEP studies at specific intervals;
- Organizing the development of projects that can be implemented within the municipality and serve as examples (energy audits in municipal buildings, preparation and implementation of renewable energy feasibility studies, implementation of energy efficiency measures, implementation of the aforementioned measures in transportation, etc.);
- To provide guidance in projects to be developed by external stakeholders in line with the Action Plan, to bring together various stakeholders, and to carry out activities in the areas of incentives and developing financing opportunities;
- To monitor and evaluate the results of the mitigation measures implemented in the city;
- Communication and dissemination efforts to raise awareness through best practice examples. to do;

If local governments lack sufficient human and financial resources, establishing a separate unit may not be feasible. Another option is to form a team within an existing institution, comprised of individuals selected from relevant departments, under the leadership and management of a designated unit.

This team should report to a Board composed of the President and senior executives. The Board's role is to support the work by defining the mission and vision. For example, the team, meeting under the leadership of the Environmental Protection Unit, should form working groups and distribute the aforementioned tasks among themselves. Meeting periodically, the team could carry out tasks such as updating greenhouse gas inventories, monitoring implementations, developing exemplary projects, and monitoring their results.

In this type of organization, assignments should be made to ensure that team members do not neglect their work groups amidst their daily tasks, and the activities to be carried out within the work groups should be included in the team's official job descriptions.

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6. CONCLUSION AND EVALUATION

The "BURSA Climate Change Action Plan" (BÿDEP) process, initiated by Bursa Metropolitan Municipality to calculate greenhouse gas emissions and create a reduction plan, truly represents much more than just a technical document prepared for the city of Bursa; it signifies a 'process'. This work is a significant step in carrying Bursa, one of the most dynamic and innovation-oriented cities in the country, into a future threatened by climate change. This 'process' requires a long-term, shared vision and the resources to realize that vision. The changing urban phenomenon, both in Türkiye and globally, with all its positive and negative dimensions, can be found in the city's energy flows. BÿDEPs bring this invisible factor of urban development to light in the context of climate change. The redesign of urban development in general, based on a participatory political approach and local governance, through aspects such as transportation, the physical development of the building stock, and the potential futures of the city's economic sectors, finds its expression in the planning of energy flows. Developing technologies... Distributed (instead of 'centralized' in English) supply systems utilizing renewable energy sources, and 'smart city' management tools enabled by information technologies, provide city administrations with very powerful new opportunities. In Türkiye, local governments can play a significant role in creating climate-resilient contemporary settlements. International experience and its inventory of 'best practices', as well as Türkiye's own experiences in participatory contemporary municipal governance, provide guidance on how these new integrated planning tools can be used to create livable settlements.

The Bursa Urban Development Plan (BÿDEP) process and its outputs, which began with the urban greenhouse gas inventory, offer numerous opportunities and synergies in integrating the physical planning of the city's development with sustainable energy planning. The Bursa Metropolitan Municipality Transportation Master Plan and the 1/100,000 scale Environmental Planning Plan strongly support the main axes of BÿDEP.

One of the key features of the Climate Change Action Plan is that it addresses the social and economic activities that define the city in all its dimensions. The plan is not limited to a single sector or area of activity. Measures to reduce greenhouse gas emissions refer to sectoral activities with economic consequences. Mitigation measures such as an efficient public transport and transportation system, an energy-efficient building stock, cost-effective energy efficiency practices in tourism activities, or investments in renewable energy are all projects requiring investment on a large or small scale and have economic consequences. The positive impacts of economic activities such as increasing energy efficiency and renewable energy investments on the local economy have been demonstrated repeatedly.

As previously mentioned, the 'Climate Change Action Plan' consists of various activities and is specific to a particular area. It is not a project or program that ends at the end of a specific period. A Climate Change Action Plan is a long-term planning process that seeks to ensure consistency between sectoral policies and orientations that will lead to reductions in the city's greenhouse gas emissions and the decision-making processes of economic actors (households, companies, public institutions, financial institutions, etc.).

As understood above, the implementation of the 'Climate Change Action Plan' requires the development of specific capacities within different units of local government, through effective communication and sharing. The proper management of the process and the monitoring and evaluation capacities of the relevant units are critical features.

The long-standing IDEP (Integrated Development Programme) initiatives in the EU aim to create a common understanding between various units of local government and the objectives of the IDEP, and to enable the implementation of different projects under the same umbrella, through budget allocation.

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It has been shown that it is important to create a high-level unit that can plan and influence the decision-making process.

This study, which marks the first steps in implementing the IEP (Integrated Development Program), is crucial for increasing participation, developing projects, securing financial resources, and monitoring results. To achieve greater participation, various communication tools should be developed, seminars and capacity-building activities should be organized, and best practice examples from other local governments working in this field should be shared. At every stage of the process, the city's economic actors—citizens, private companies, NGOs, professional chambers and associations, universities, central decision-making bodies, and other public institutions—should be involved.

The Climate Change Action Plan; the Bursa Metropolitan Municipality Transportation Master Plan, and the Environmental Planning Plan, all prepared for the Bursa province. The actions included in this plan are consistent with the titles, aims, and objectives of major documents prepared for Bursa and the region, such as the 2014-2023 Regional Plan prepared by BEBKA.

With BÿDEP, actions have been planned to serve the aims of "reducing global warming, protecting the environment, and changing Türkiye's perception in the world by ensuring the use of clean energy" and "ensuring the conversion of solid waste into energy through different methods". The outputs of the BBB Transportation Master Plan are consistent with the BÿDEP mitigation measures in terms of the emphasis placed on bicycle and pedestrian transportation, public transportation and their integration.

The "Climate Change Action Plan" for Bursa presents a planning tool that integrates different elements of urban development, using background energy and greenhouse gas intensities to prioritize different development options.

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SOURCES

Bursa 2030 Environmental Planning Map, Scale 1/100,000, Bursa Metropolitan Municipality, 2012

Bursa 2030 Environmental Planning Map, 1/100,000 Scale, Synthesis Report, Bursa Metropolitan Municipality 2012

Bursa 2030 1/100,000 Scale Environmental Planning Map, Environmental Planning Housing and Social Facilities Report, *Bursa Metropolitan Municipality 2012*

Bursa Municipality Corporate and City-Scale Greenhouse Gas Inventory Report, July 2015

Feasibility Study for Biogas Plants in the Bursa Region – FASEP project, Bursa Metropolitan Municipality, ENEA, ESETA Consulting, 2014

Bursa Metropolitan Municipality Integrated Solid Waste Management Plan, March 2015

Bursa Transportation Master Plan, Bursa Metropolitan Municipality, 2012

Bursa Clean Air Action Plan

Bursa Eskiÿehir Bilecik Development Agency, BEBKA, TR41 2014-2023 Regional Plan

"Investigation of the Usability of Geothermal Energy in Bursa and its Surroundings" Akÿn Burak ETEMOÿLU et al. Uludaÿ University Journal of Engineering and Architecture Faculty, Volume 11, Issue 1, 2006, Uludaÿ University, Faculty of Engineering and Architecture, Department of Mechanical Engineering, 16059, Görükle, Bursa

Ministry of Energy and Natural Resources, www.enerji.gov.tr

Energy Efficiency Law, No. 5627, 2007.

GIS mapping of biogas potential from animal wastes in Bursa, Turkey, ÿlkbaÿ ÿ.-Özsoy G., Int J Agric & Biol Eng, 2015; 8(1): 74 83

IEA Countries' Energy Policies: Türkiye, 2009.

International Local Government GHG Emissions Analysis Protocol (IEAP), ICLEI, 2009.

IPCC 2006 Guidelines for National Greenhouse Gas Inventories, Jim Penman et.al., 2007.

Low Carbon Development Strategies: A Primer on Framing Nationally Appropriate Mitigation Actions (NAMAs) in Developing Countries, UNEP, 2011.

McKinsey Global Institude, Cityscope 1.0, 2010.

Pathways to a Low-Carbon Economy v.2 of Global GHG Abatement Cost Curve, McKinsey&Co., 2009.

Paving the way for low-carbon development strategies, Xander van Tilburg et.al., Energy Research Center of the Netherlands.

Turkish Ministry of Energy and Natural Resources 2010-2014 Strategic Plan.

The Greenhouse Gas Protocol Corporate Reporting Satndard Revised Edition, WBCSD-WRI.

Turkish Statistical Institute (TÜyK), www.tuik.gov.tr

Development of Türkiye's Climate Change Action Plan Project: Current Situation in the Buildings Sector Evaluation Report, Tülin Keskin, August 2010

Transportation Sector, Current Situation Assessment Report, Ministry of Environment and Urbanization, 2010.

National Climate Change Strategy Document: Türkiye Joins the Solution, Republic of Turkey Ministry of Environment and Forestry, 2009.

Machine Translated by Google

Urban world: Mapping the economic power of cities, McKinsey Global Institute, 2011.

World Urbanization Prospects The 2011 Revision, United Nations Economic & Social Affairs, 2012.